Study on market for jetfuel in India

Report Prepared for Kuwait Petroleum International Aviation Company Ltd.

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Abbreviations

AFS	Aviation Fuel Station
AI	Air India
APM	Administered Pricing Mechanism
ATF	Aviation Turbine Fuel
ATKM	Available Tonnes Kilometer
BAU	Business As Usual
BCAS	Bureau of Civil Aviation Security
BG	Broad Gauge
BPCL	Bharat Petroleum Corporation Limited
C & F	Cost and Freight
CIF	Cost Insurance & Freight
CVD	Countervailing Duty
DGCA	Directorate General of Civil Aviation
DPK	Dual Purpose Kerosene
EIPL	East India Petroleum Limited
FDI	Foreign Direct Investment
FOB	Free on Board
FSP	Freight Surcharge Pool
GAIL	Gas Authority of India Ltd.
GDP	Gross Domestic Product
HPCL	Hindustan Petroleum Corporation Limited
HSD	High Speed Diesel
IA	Indian Airlines
IAAI	International Airports Authority of India
IBP	IBP Co. Limited
IOC	Indian Oil Corporation
JV	Joint Venture
Km	Kilometer
Lacs	10^5
LPG	Liquefied Petroleum Gas
MCLR	Medium Capacity Long Range
MMT	Million Metric Tonnes
MMTPA	Million Metric Tonnes Per Annum
MOU	Memorandum of Understanding
MPCE	Monthly Per-capita Expenditure
MT	Metric tonnes

MTPA	Metric Tonnes Per Annum
NAA	National Airports Authority
NRIs	Non Resident Indians
NSSO	National Sample Survey Organisation
OCC	Oil Coordination Committee
OISD	Oil Industry Safety Directorate
OPC	Oil Prices Committee
PDS	Public Distribution System
PG	Persian Gulf
PPA	Product Price Adjustment
PSUs	Public Sector Undertakings
PSUs	Public Sector Undertakings
RTKM	Round Trip Kilometres
SCLR	Short Capacity Long Range
SCSR	Short Capacity Short Range
SDP	State Domestic Product
TAIPP	Tariff Adjusted Import Party Price
TMT	Thousand Metric Tonnes
TMT	Thousand Metric Tonnes
TOP	Tap Off Point
USD	US Dollars
Vishakh	Vishakhapatnam

Introduction

Kuwait Petroleum International Aviation Company (KPIAC) Limited is the international jetfuel marketing arm of Kuwait Petroleum Corporation (KPC), who have formed a joint venture (JV) with IOC for the setting up of a refinery in India. KPIAC is interested in entering the jetfuel market in India, initially on the basis of imports and later by way of swap deals with products from KPC's JV refinery, enabling them to make jetfuel available at various airports in the country.

With this background in mind, KPIAC have commissioned TERI to undertake a study on the potential market for jetfuel in India..

Specifically, the terms of reference for the study are as follows:

- **Government policy for the Indian aviation industry**
  Current and proposed future government policy for the Indian aviation industry with respect to:
  Deregulation of the airline industry.
  Deregulation of the oil industry and opportunities/barriers for private sector entry into the jetfuel marketing business.

- **Jetfuel demand/supply balances**
  Analysis of current and projected all-India demand/supply balances till the year 2010.
  Key demand centres for jetfuel in India
  Projected all-India sales separately for the domestic and international sectors.
  Jet fuel supplies on the basis of current & future refining capacities, yield patterns of the refineries, jetfuel and kerosene yields
  Facilities being planned to handle the projected growth.
  Imports of dual purpose kerosene (DPK) in the past and currently, sources and import locations.

- **Logistics**
  Current infrastructure for supplying jetfuel from refineries / coastal import locations to airfield service stations.
  Plans for augmentation of the infrastructure.
  Import possibility to seed the market in advance.
  Port capacities and vessel sizes.
  Availability of spare storage hospitality with public sector oil companies.
  Ability of terminals importing kerosene to switch to jetfuel.
  Availability of private terminalling facilities.
  Briefing on movement of petroleum products by rail in general and operation of block trains in particular.
  Present & proposed pipeline systems.
  Current pipeline tariffs and access to future pipeline systems.
  Possibilities of swap deals with other oil companies.

Airport Infrastructure
Infrastructure status at 10 major airports[a] (Mumbai, Calcutta, Delhi, Chennai, Thiruvanthapuram, Bangalore, Hyderabad, Guwahati, Ahmedabad, and Bhubaneshwar) - hydrant or refueller mode of fuelling, name of operator, mode of supply - pipeline, rail or road, etc.

Though Bhuvaneshwar is not a major airport it is included due to its proximity to the proposed KPC/IOC refinery in Orissa.

A map showing location of refinery/coastal/inland installations, pipeline systems and domestic and international airports.

- **Jetfuel Pricing**
  An in-depth analysis of the current pricing system along-with the road map to import parity levels.
  Duties applicable to jetfuel imports.
  Break up and derivation of international and domestic jetfuel prices.
  Terminal charges, airfield charges, other charges and current sales tax for jetfuel in each state.

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[a] It was indicated that it is a tentative list, which may be amended. TERI has modified the list to include Cochin, which has commenced international operations since May 1999. Lucknow is included and Guwahati is dropped.

Report structure

For conducting the above scope of work, in addition to the deskwork, extensive fieldwork was undertaken and interviews were conducted. The team contacted various officials from Ministry of Civil Aviation, Directorate General of Civil Aviation, Airport Authority of India, Oil Coordination Committee and other oil companies. Discussions with the major Indian as well as international airlines, were conducted which included officials from Lufthansa, KLM and Air India. Representatives of Indian Airlines and Jet Airways were very helpful in providing information regarding the domestic sector. Also, the team contacted the Confederation of Indian Industry, which has recently commissioned National Council for Applied Research (NCAER) to conduct a study on the performance of the aviation sector and forecast the prospects. Discussions were held with NCAER on the status of the study, as also the methodology for demand projections.

TERI has examined demand originating only from the civil aviation sector and not from the defence services.

The report has been structured as follows to provide a logical flow to the analysis.

Chapter 1: The history of civil aviation in India

This chapter provides an overview of the civil aviation industry in India. The growth that has taken place during the pre and post liberalisation periods, in the domestic and international airlines segment is discussed. Details regarding the three distinct functional entities in the civil aviation industry, related to the regulatory cum development, operational and infrastructural functions are also mentioned. Finally, it provides the national civil aviation policy of 1997 and the future prospects of the industry with respect to airlines and airport infrastructure.

Chapter 2: Jetfuel demand projections

All India and regional jetfuel demand projections have been developed. The demand estimates are provided separately for the domestic and international operations under two scenarios. These are aggregated for the select airports from 1999/00 to 2010/11.

Chapter 3: Supply-demand Balances

The regional supply-demand balance for jetfuel is provided under the two scenarios that are defined in the chapter. The supply projections are based on the indicated yield patterns of individual refineries, while the demand projections are taken from the Chapter 2 under the two scenarios. The projections are made till year 2010/11 and analysed in terms of any need for jetfuel imports to India.

Chapter 4: Petroleum products infrastructure and jetfuel supply logistics

Existing distribution arrangements for various petroleum products are discussed. The dependence of petroleum industry on various modes of transportation, viz., pipelines, rail tank wagons, tankers and tank trucks, is also elaborated. The chapter provides information on the role of Oil Coordination Committee (OCC) with respect to distribution/supply plan mechanism for petroleum products. In particular, movement of jetfuel in India from coastal and inland refineries and its distribution by tankers for coastal movement, through local and long distance product pipelines, by rail tank wagons and by road tank trucks is also described. In addition, inter company product exchange, sale and hospitality arrangements are provided.

Chapter 5: Infrastructure at major airports

Details regarding the infrastructure status in terms of mode of supply – pipeline, rail or road storage, mode of fuelling (hydrant or refueller), name of operator, for the six international airports viz., Delhi, Mumbai, Calcutta, Chennai, Thiruvanthapuram and Cochin-and few other domestic airports including Lucknow, Ahmedabad, Bangalore, Hyderabad, and Bhuvaneshwar, are provided in this chapter.

Chapter 6: Pricing

The current price build up for domestic and international airlines is provided. The evolution of pricing especially after deregulation is also suggested. Jetfuel selling price build-up at Aviation Fuel Stations for domestic airlines on the basis of ex storage point price is also determined.

Chapter 7: Observations and Conclusions

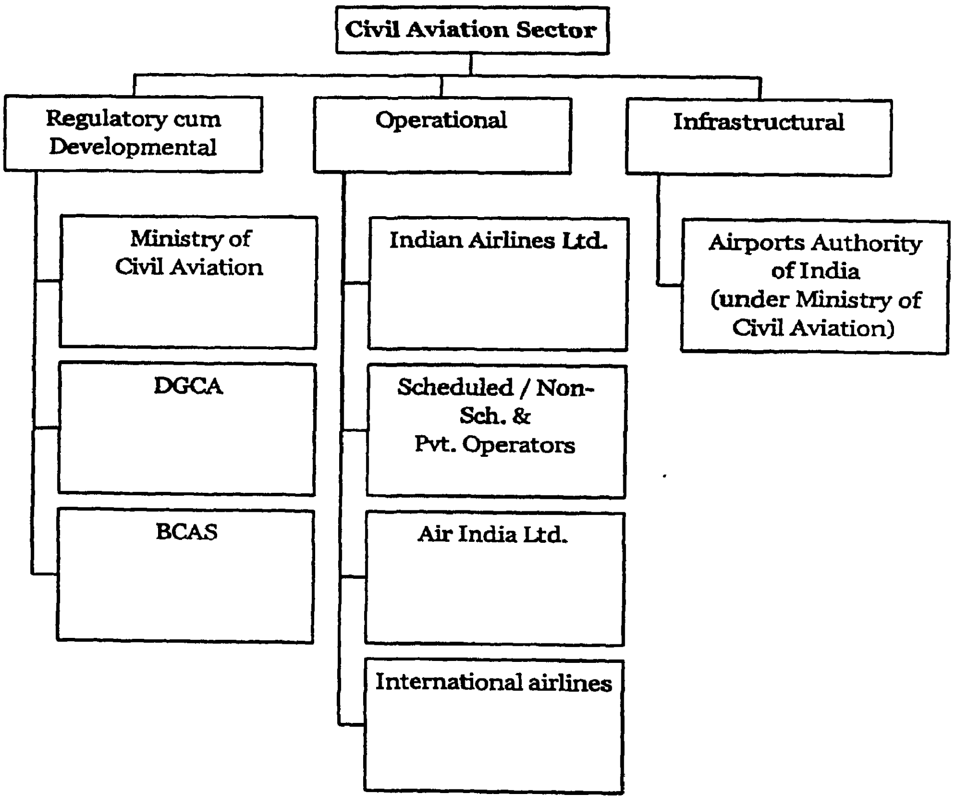
Based on the analysis in the foregoing chapters, key observations and conclusions are provided in this Chapter.

Executive summary

The history of civil aviation in India

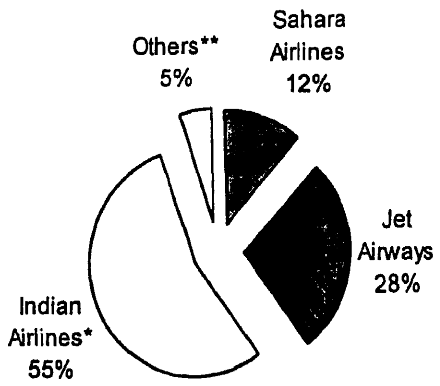
The civil aviation industry in India has experienced a reasonable growth rate of 8% since 1984. In 1998-99, the total passengers carried on international carriers reached 10.89 million and those by the domestic carriers were 12.09 million. There has been considerable increase in the cargo movement also, which amounted to 521,000 tonnes in 1998-99.

The aviation industry is categorised into three distinct functional entities as depicted in the chart below:


Civil Aviation Sector
Regulatory cum Developmental
Operational
Infrastructural
Ministry of Civil Aviation
DGCA
BCAS
Indian Airlines Ltd.
Scheduled / Non-Sch. & Pvt. Operators
Air India Ltd.
International airlines
Airports Authority of India (under Ministry of Civil Aviation)

Currently, there are 6 scheduled and 22 non-scheduled operators in the domestic aviation scenario. Besides Air India and Indian Airlines, the private operators- Jet Airways and Sahara Airlines cater to domestic routes. Figure 1 gives the domestic air traffic share commanded by these airlines vis-à-vis Indian Airlines.

Figure 1: Proprtional share of scheduled operators in domestic air traffic.



*Indian Airlines also include its subsidiary Alliance Air services.
** Others also include traffic catered to by Air India.

On the international front, besides Air India, Indian Airlines supplements its services by catering to as many as 17 international destinations. Other international carriers are Lufthansa, KLM, Swissair, SAS, British Airways, Air France, etc. from the west and JAL, Thai Airways, Singapore Airlines, Cathay Pacific, etc. from the east that cater to the maximum international travel to and from India.

However, Air India and Indian Airlines have been steadily losing their share of international traffic to the foreign counterparts. While Air India has curtailed its flights to some destinations as Manchester, Germany and Rome owing to its fleet constraint, Lufthansa, Air France and British Airways have increased their flight frequency to and from India. On the other hand, foreign carriers as Air Canada, United Airlines, Taron (Romanian airlines) have closed shop in India since the route they catered to did not generate enough traffic to make profits.

In 1997, the government of India announced the policy for civil aviation industry broadly, with regards to the airlines and airport infrastructure. The overall objective of the policy was to increase the private sector participation and make rules lucrative for increasing investments by the private parties. The airport infrastructure policy aims at raising funds to finance the upgradation and modernisation plans at the various airports in India and to increase the connectivity between the metros and other cities. The future prospects of this industry seem very promising with many private airlines making foray in this sector. On the infrastructure front, the government has decided to offer the five airports, namely Delhi, Mumbai, Calcutta, Chennai and Bangalore, on a long term lease basis to private companies.

Jetfuel demand projections

Jetfuel sales in 1998/99 aggregated to 2097 TMT of which sales to international flights accounted for 55% of the total trade, while the domestic and defence requirements totalled to 25% and 20% respectively. Sales were not uniformly distributed throughout the country and were primarily concentrated at international airports. The northern and western regions, with the international airports of Delhi and Mumbai, accounted for 40% and 33% of the trade respectively.

Demand projections for jetfuel have been restricted to those for the civil aviation sector only, with the share of defence assumed to be a constant 20% in the projection period. Demand analysis was segregated for domestic and international operations. On account of limited cargo operations in the country, demand projections for jetfuel are developed from estimates of growth in passenger traffic only.

Domestic demand for air travel is primarily accounted for by business travel (70%), followed by that from foreign tourists visiting India (20%) and non-resident Indians visiting relatives back home (7%). Leisure/emergency travel constitutes a marginal 3% only.

Two scenarios are developed for assessing demand for domestic air travel. The baseline analysis involved identification of key macro-economic parameters likely to influence the demand for air travel and the subsequent estimation of a representative econometric model. The demand for domestic air travel was posited as a function of the gross domestic product (GDP), Index of Industrial production (IIP), foreign tourists arrivals (FTA), foreign direct investments (FDI) and yields (average revenue per passenger kilometre). Model specifications and analysis of regression results, however, rendered all of the above mentioned, except the industrial component of GDP, to be statistically insignificant or if significant, the results to be counter intuitive. Passenger traffic is, thus, finally modelled as a function of the industrial component of GDP only. Jetfuel demand for domestic flights is subsequently regressed from growth in passenger traffic.

The alternate scenario employed an international cross-sectional analysis of domestic air travel utilisation across countries at different stages of development. It is hypothesised that utilisation of air travel would be higher in developed countries in comparison to developing countries, wherein the stage of development was measured through per capita income levels. A regression equation is estimated that correlated per capita utilisation of air transport services to per capita income levels which rendered statistical credibility to the above mentioned hypothesis. Finally, based on the projected per capita income levels in the country, the likely utilisation of air transport services is estimated. Jetfuel demand is subsequently regressed from the growth in demand for air travel.

Jetfuel demand for domestic flights, as estimated above, rises from a current level of 524 TMT to 963 TMT in the baseline scenario and 1112 TMT in the alternate scenario by the year 2010/11. These numbers translate into an annual growth rate in jetfuel demand of 5.2% in the baseline scenario and 6.5 % in the alternate scenario.

After an in depth analysis of the international air traffic, it is deduced that the demand for air travel is influenced by a number of exogenous variables and that the abstraction of a representative mathematical formula that captures these externalities is improbable. Consequently, the demand for international traffic is based on an industry survey wherein the project team interacted with key international airlines operating in India. Growth expectations for international passenger traffic range from an optimistic level of 12% per annum to a pessimistic growth rate of 8%, which formed the alternate and baseline scenarios respectively.

Jetfuel demand for international flights, subsequently regressed from growth in passenger traffic, rises from a current level of 1136 TMT to 1959 TMT in the baseline scenario and 2511 TMT in the alternate scenario by 2010/11, thereby registering an annual growth of 4.5% and 6.8% respectively.

Adding on the requirements of defence forces, estimated at 20% of the total demand, the aggregate demand for jetfuel rises from 2097 TMT to 3653 TMT in the baseline scenario and 4529 TMT in the alternate scenario by 2010/11translating into an annual growth of 4.7% and 6.6% respectively.

Due to the long gestation periods in setting up greenfield airports, regional demand in the projection period has been assumed to be in the same proportion as that in the base year. Jetfuel demand, thus, continues to be dominated in the North closely followed by the West as summarised in the table below.

Aggregate jetfuel demand projections (TMT)

Region	Baseline Scenario			Alternate Scenario		
	2000/01	2005/06	2010/11	2000/01	2005/06	2010/11
North	935	1165	1451	976	1326	1800
South	428	534	665	447	608	825
East	224	279	348	234	318	432
West	765	953	1188	799	1085	1473
Total	2352	2931	3653	2456	3337	4529

Supply-demand balances

Jetfuel availability in the country is estimated from projected refinery throughputs and the yield patterns of each refinery. Refinery throughputs are based on the latest available information on new projects/expansions and a review of progress made on these projects till date. Expansions/additions to refining capacity beyond 2006/07 are not known. The cumulative throughput of domestic refineries is expected to rise from about 69 MMTPA in 1998/99 to 129 MMTPA by 2001/02 and about 185 MMTPA by 2006/07. Throughputs in 2010/11 have been assumed to be the same as in 2006/07.

These throughputs translate into a domestic availability of jetfuel 6423 TMT by 2010/11. On account of a concentration of refining capacity in the western region, jetfuel availability from refineries in the west account for about 35% of the total availability, with the northern and southern regions accounting for about 25% of the total output each.

In contrast, jetfuel demand in the same year aggregates to only 3653 TMT in the baseline scenario and 4529 TMT in the alternate scenario. These numbers indicate an overall surplus of 40% and 75% in the two scenarios respectively. The surplus is highest in the western region followed by the southern region. However, in the alternate scenario, the northern region indicates a deficit of 188 TMT, which is likely to be met from the surplus in the west.

Regional supply -demand balance (TMT)

Region	Baseline Scenario			Alternate Scenario		
	2000/01	2005/06	2010/11	2000/01	2005/06	2010/11
Supply						
North	1107	1544	1611	1107	1544	1611
South	748	1512	1512	748	1512	1512
East	374	1137	1137	374	1137	1137
West	1255	2129	2163	1255	2129	2163
Total	**3484**	**6322**	**6423**	**3484**	**6322**	**6423**

Region	Baseline Scenario			Alternate Scenario		
	2000/01	2005/06	2010/11	2000/01	2005/06	2010/11
Demand						
North	935	1165	1451	976	1326	1800
South	428	534	665	447	608	825
East	224	279	348	234	318	432
West	765	953	1188	799	1085	1473
Total	**2352**	**2931**	**3653**	**2456**	**3337**	**4529**
Surplus						
North	173	380	160	131	218	-188
South	320	978	846	301	904	687
East	150	858	789	140	819	706
West	490	1176	975	456	1044	690
Total	**1132**	**3391**	**2771**	**1028**	**2985**	**1894**

Given the expected overall surplus situation for jetfuel, it is expected that the new refineries would refrain from developing jetfuel manufacturing capacity and instead maximise Kerosene availability, the demand for which is likely to grow in the future.

An analysis was done to determine jetfuel availability with supply from existing refineries and expansions of existing refineries only. In such a scenario also, the availability at 4370 TMT exceeds demand at 3653 TMT in the baseline demand scenario. However, in the alternate demand scenario, the demand rises to 4529 TMT, resulting into an overall deficit of 160 TMT. The deficit emerges from deficits in the northern and the eastern region.

It is envisaged that, in such a situation, the deficits in the north would be met from jetfuel availability at the new BPCL refinery in the state of Punjab in the northern region and from the Essar refinery in the state of Gujarat in the western region. The deficit in the east is likely to be met from dual purpose kerosene (DPK) availability from the Paradip refinery in the state of Orissa. However, the deficit of 45 TMT only, contrasts poorly with availability of 750 TMT of DPK.

In conclusion, the excess domestic availability of jetfuel obviates the need for any imports into the country. The excess manufacturing capacity may either not be built or could be used to make DPK.

Petroleum products infrastructure and supply logistics

Till recently, marketing of petroleum products was being handled by four oil companies exclusively in the public sector (PSUs). Three of these companies, viz. IOC, HPCL and BPCL are integrated refining and marketing companies, whereas IBP purchases products from the refiners for resale. Besides direct despatches from the refineries distribution of major petroleum products by the four PSUs is undertaken from a total network exceeding 46 Marketing Port Terminals (at 22 locations), 37 installations at pipeline tap-off points/terminals (at 23 locations), 260 inland depots and installations (at 152 locations) and terminals at seven inland refinery locations, having an aggregate tankage of nearly 10 million Kl. Some private marketers, including a few multinationals, are now marketing LPG and kerosene under the parallel marketing scheme.

Movement of products by tankers from coastal refineries is a regular feature to cope with product imbalances and to position products at a pivotal port terminal like Kandla on the west coast from where large scale movement is undertaken into the deficit North-West region.

Railways is another mode for transporting products, but this mode has not been able to fully move the petroleum products traffic offered to them. Over the past few years, the oil industry has had to resort to very sizeable road bridging in order to maintain supplies to their upcountry storage points. The expansion of product pipeline network in India has been slow until now due to stiff opposition by the Government owned Indian Railways. However, recently, the Government has approved the formation of a holding company, Petronet India , for the implementation of petroleum product pipeline projects. The move was aimed at encouraging private investment in pipeline projects and appears to be a preparatory measure for ultimate decontrol of the oil industry.

The pool of available administered products in the country from all refineries and LPG Fractionating plants, as well as imports to cover deficit products, is shared between the PSUs. Each refinery, regardless of its ownership or right of sale for products, is open to all PSUs for drawing their requirements. Similarly, each oil company has a call on the imported products, though all imports are being canalised through IOC. The sourcewise and productwise share out of each oil company is regulated through the monthly supply plan discipline. These are handled by the canalising agent, IOC by availing of coastal facilities of all oil companies at the ports of receipt. The receiving company pays IOC for the imported product thus supplied and uses the product for its own sales.

a) The supply plan is prepared only for the remaining administered products, viz. LPG (for domestic consumers), motor spirit, kerosene (for PDS), jetfuel, HSD and NGL condensate in the prevailing SPM format which is now authorised by OCC. Authorised road bridging plan for administered products only constitutes a part of the SPM. Methodology for settling companywise claims under authorised bridging plan from the freight surcharge pool has been restated by OCC.

b) A separate 'Industry Logistics Plan' (ILP) for decontrolled products other than those mentioned under (a) above, is drawn up by PSUs and movements planned through ILP do not have any reflection on the Oil Pool Account. Any under/over-recoveries in freight etc. on decontrolled products are on PSUs' account.

c) OCC continue to coordinate with Ministry of Surface Transport and major ports as well as Ministry of Railways and other concerned Ministries in respect of movement of all petroleum products. However, the responsibility for marketing and transportation of all deregulated products by all modes rests with the PSUs effective 1st April 1998.

Supplies of jetfuel have to reach more than 65 Aviation Fuel Stations (AFSs) handling civil air traffic spread over a vast area throughout the country. A network of suitable jetfuel storage points is being deployed by PSUs to feed the AFSs. The network is a part of their much bigger distribution infrastructure in use for meeting consumer needs of transportation fuels and all other petroleum products throughout the country. Apart from the jetfuel producing refinery locations and some port terminals, the jetfuel storages have, in fact, been set up only at those selected upcountry petroleum products installations and depots of the oil industry from where it is expedient to make jetfuel deliveries to nearby AFSs. There are four port terminals (Kandla, Vasco, Budge Budge and Port Blair), receiving supplies from coastal refineries, 6 TOPs/terminal points on pipelines and 11 major inland installations receiving supplies by rail tank wagons.

The modes of transport used for moving jetfuel from supply sources to jetfuel storage points and thereafter to AFSs, are the same as for other white oils i.e. by tankers for coastal movement, through local and long distance product pipelines, by rail in tank wagons and by road in tank trucks. Similar primary or complementary despatch facilities exist at the corresponding marketing terminals of PSUs depending upon the extent of jetfuel despatches handled directly from each refinery. In addition, the marketing terminals at the coastal location Tondiarpet in Chennai are equipped to receive small tanker parcels of jetfuel from other coastal refineries or, if required, through imports. The airports and Delhi and Mumbai receive jetfuel by pipeline, while for the remaining major airports, tank trucks are the mode of supply.

Maintenance of jetfuel product quality being of paramount importance, special care is taken to ensure that the product does not go off-specification during transportation. Jetfuel tanks at all marketing terminals are epikote lined, fit for jetfuel storage. The loading and discharge lines are flushed as per standard laid down practices so as to maintain product specification and ensure quality control.

In the likely event of jetfuel import becoming necessary at any stage, the PSUs are in a position to undertake it at their Kandla, Vasco and Budge Budge port terminals and at their Chennai marketing terminals. The three port terminals normally receive jetfuel supplies in tanker parcels from coastal refineries.

In view of inadequate jetfuel tankage at these port and marketing terminals individually, an MR vessel could be received on two or multi-port discharge basis. Indeed, such an arrangement was resorted to when an odd jetfuel import was required some time back. However, it is logical to assume that PSUs will go for such imports only to meet their own needs and it is highly unlikely that they will offer the use of their jetfuel storage and other import facilities for any private marketer after deregulation, by jeopardising their own trading interests. Even the existing product sharing arrangements between PSUs themselves are going to come under strain post-deregulation and the shape of swap deals or revised hospitality arrangements emerging thereafter remains to be seen.

Development of product storage terminals by private parties for use by interested private marketers of petroleum products presently on free trading list is in its initial stages. A couple of other small private terminal operators at Kandla and some other port are also reportedly entering the fray. None of these operators presently handle jetfuel but one or two of them may feel interested to take up this task, if it proves remunerative.

Infrastructure at major airports

Airports are presently classified as follows:

International airports: These are available for scheduled international operations by Indian and foreign carriers. Currently, Delhi, Mumbai, Chennai, Calcutta, Cochin and Thiruvanthapuram fall in this category.

Custom airports: These have customs and immigration facilities for limited international operations by domestic carriers and for foreign tourists and cargo charter flights. Bangalore, Hyderabad, Ahmedabad, Calicut, Goa, Varanasi, Patna, Agra, Jaipur, Amritsar and Tiruchirapally are included here

Domestic airports: Domestic airports which have minimum runway length of 7500 feet and adequate terminal capacity to handle airbus 320 type aircrafts belong to this category. These can handle limited international operations, if required. These include Lucknow, Bhubaneshwar, Guwahati, Nagpur, Vadodra, Coimbatore, Imphal and Indore.

Other domestic airports: All other airports are covered in this category.
Civil enclaves in Defence airfields

In additional to the six international airports there are 86 domestic airports and 28 civil enclaves. The latter are essentially defence airfields, where civilian flights are also allowed.

The top five airports at Delhi, Bangalore, Mumbai, Chennai and Calcutta handle nearly 75% of the total air-traffic. Ten other airports including Hyderabad, Thiruvanthapuram, Ahmedabad, Cochin account for 16% of the traffic.

Of the total jetfuel sales of 2097 TMT in 1998/99, IOC had a predominant share of 70% followed by BPCL & HPCL with shares of 22% and 8% respectively.

Of the 11 airports for which a detailed study was undertaken, all airports are owned by AAI, except Cochin which is a joint venture between the State Government and BPCL, and the Bangalore airport, which is owned by Hindustan Aeronautics Ltd.

The major international operations in India occur at the airports at Delhi, Mumbai, Calcutta & Chennai.

Sales to international airlines (000 kl)

Airport	Total International + Domestic	International Sales			
		Total	IOC	BPCL	HPCL
Delhi	806 (626)	606 (470)	312	252	42
Mumbai	675 (524)	509 (395)	220	188	101
Cochin	11.3 (9)	10.5 (8)	5.4	4.0	1.1
Thiruvananthapuram	52.0(40)	49 (38)	37.1	11.9	N.A.
Chennai	174.1 (135)	90.5(70)	72.6	5.6	12.4
Calcutta	82.2 (64)	-	Of total Sales IOC : 73%, BPCL : 14%, HPCL : 13%		
Total	1800.6 (1398)	1265 (981)			

Figures in brackets are in TMT

Delhi, Mumbai and Cochin are the only three airports with hydrant facilities to fuel the aircrafts. Delhi and Mumbai also account for major international jetfuel sales, followed by Chennai. All the three major PSUs are present at the international airports, with IOC taking the lead share.

Expansion plans are envisaged for Cochin, Thiruvanthapuram and Chennai, whereas proposals for new international airports are in the offing at Revas-Mandava, near Mumbai, and at Tambram, south of Chennai. Also, hydrant systems are planned at Calcutta and Thiruvanthapuram airports.

There are significant sales to domestic carriers at the domestic terminals of the international airport. In addition, data for five other major domestic airports is provided below.

Sales to domestic carriers at major airports ('000 kl)

Airport	Sales in 98/99 ('000 kl)	IOC	BPCL	HPCL
International				
Delhi	200 (155)	144	32	24
Mumbai	166 (129)	109	41	16
Cochin	0.8 (0.6)	0.3	0.5	Neg.
Thiruvananthapuram	3.0 (2)	1.8	1.2	N.A.
Chennai	83.5 (65)	67.0	5.2	11.4
SUB TOTAL	453.3 (352)			
Domestic				
Lucknow*	9.6 (7)	9.6	N.A.	N.A.
Ahmedabad*	24.5 (19)	19.8	4.7	N.A.
Bangalore	71.6 (55)	56.7	14.9	N.A.
	[15.7 for intnl.]	[12.4 for intl]	[3.3 for intl]	
Hyderabad	33.3 (26)	28.6	4.7	N.A.
	[10.3 for intnl.]	[8 for intnl]	[2.3 for intnl]	
Bhubaneshwar	8.1 (6)	7	1.1	N.A.
SUB TOTAL	147.1 (113)			

Note: For Calcutta, total jetfuel sales are known. Separate estimates for domestic & international operations, and by company are not available.

NA: Not applicable

*: Sales made for limited international operations are not available separately.

Figures in ( ) are in TMT.

IOC has the predominant market share in sales to domestic carriers at the 11 airports, for which information was sought.

As the predominantly domestic airports also cater to limited international traffic, there are plans to refurbish these by building new terminal complexes and extending the runway lengths to handle bigger crafts. At Ahmedabad a new international terminal is planned, whereas there is a proposal to establish a new international airport at Bangalore. The agencies being considered for the new airport at Bangalore is are Reliance/Change airport, Birnken Hope, Siemens and Zurich airport, Stefal, Bechtel and Dubai Airport, and ABB. There are also plans to build a new international airport at Samshabad, close to Hyderabad.

Jetfuel pricing

After deregulation of refining sector effective 1st April 1998, the practice of establishing product-wise ex-refinery prices as weighted average of retention prices of various refineries was dispensed with. Also, prices of only five products, viz. Motor Spirit, High Speed Diesel Oil, Kerosene (for public distribution scheme), LPG (for domestic sales) and jetfuel are controlled from the above date. The marketing companies now determine the selling prices of other decontrolled bulk products themselves on the basis of import parity.

Effective 1st April 1998, erstwhile ex-refinery prices of the five controlled products including jetfuel sales, have been replaced with Tariff Adjusted Import Parity Prices which are worked out by OCC every month based on landed cost, viz. c.i.f. price, ocean loss, landing charges, customs duty and countervailing duty. The monthly TAIPPs form the basis on which payments are made to all refineries, including joint venture and private sector refineries, by the marketing companies for their upliftments of controlled products. No change in the retail selling rates is however made by the companies on the strength of monthly revisions in TAIPPs and any such change requires specific government approval. OCC also work out ex-refinery gate prices of public sector, joint sector and private sector refineries every month and inform the refineries of the prices fixed in each case. The precise methods of calculation of the TAIPPs and the ex-refinery prices by OCC are not known and therefore lack transparency. Reportedly the ex-refinery gate prices, inter-alia, take into account the respective crude costs of each refinery on the basis of the type of crude mix it refined, viz. totally indigenous or imported or partly both. The companies make adjustments with OCC to settle the difference between TAIPPs and their respective ex-refinery gate prices.

Basic selling price of jetfuel sold to domestic operators under the administered system (Rs. per kl)

	June 1999	January 2000
Tariff Adjusted Import Parity Price	7118.76	10294.93
Marketing Margin	178.12	178.12
C & F Surcharge	1120.00	781.00
FSP Surcharge	256.00	302.00
Product Price Adjustment (PPA)	2086.44	- 796.70
Ex-storage point price (excluding excise duty)	10759.32	10759.32
AFS charge	254.73	254.73
PPA for AFS charge	- 230.29	- 230.29
Ex-International Airfield (Airport) basic Price	*10783.76	*10783.76
Surcharge for other Airfields	17.50	17.50
Ex-other Airfield (Airport) basic Price	#10801.26	#10801.26

Note: C& F surcharge and FSP surcharge are elements to take care of variations in cost of imported product, exchange rate etc and for freight differential between the actual freight and the nominal freight included in the price build up. PPA account takes care of the cross-subsidisation between products.

The ex-storage point price remained unchanged despite steep increase in TAIPP due to spurt in f.o.b. prices of jetfuel in December, 1999 and January, 2000. No change has been made in the jetfuel selling price for sales to domestic airlines due to absence of any such decision by the government. The increase in TAIPP has been adjusted in the PPA. Due to TAIPP reflecting the landed cost on import parity basis, the PPA has become a substantially negative figure in January, 2000 unlike the position shown in Table 6.1 under the retention price system where PPA was a high positive amount yielding overrecoveries to provide credit for the pool accounts.

For domestic airlines, once the ex-storage point price is decided, , certain surcharges, railway freight, excise duty and sales tax are levied.

Since the jetfuel selling prices for domestic airlines were maintained through price control at a high level to subsidise kerosene (sold through public distribution system) and LPG (for domestic sales), the international airlines showed strong reluctance to draw jetfuel supplies at Indian international airports. Operations of Air India – the country's own international airline – would also be severely affected if they were to pay the higher jetfuel rates applicable for domestic air traffic.

The government therefore instituted a separate basis for determining jetfuel prices for international airlines operating through India, including supply of jetfuel to the national airlines for international traffic. An empowered Standing Committee was constituted to fix jetfuel prices for international airlines, with representatives of the Ministry of Petroleum and Natural Gas, OCC and the three marketing companies IOC, BPCL and HPCL as its members. The committee closely monitors international prices of jetfuel with special attention to price levels in neighbouring countries like in Persian Gulf, Nepal, Sri Lanka, Bangladesh, Pakistan etc. It decides on the changes to be effected in jetfuel prices and IOC act as coordinators to circulate the ruling prices from time to time to all concerned. At times, the price changes can be frequent i.e. 4-5 times per month. The committee announces the final composite price to be recovered from international airlines, excluding state sales tax which is to be charged, as applicable.

Revision in jetfuel prices applicable to international airlines at Indian airports

Effective date	Ruling price	
	US Cents per US gallon	US $ per kl
01-12-1999	85.49	225.84
22-12-1999	88.81	234.61
04-01-2000	89.70	236.96

International airlines have refused to pay the levy of state sales tax citing inter-governmental bilateral agreements with the US, UK and other European countries. The Indian marketing companies IOC, BPCL and HPCL have consequently been left with no other alternative but to pay the sales tax themselves and have requested the Ministry of Petroleum & Natural Gas to raise the issue with other concerned ministries of the government to get it resolved.

It is reported that the Cabinet has recently decided to provide jetfuel at international prices to turbo prop aircrafts plying on unviable regional routes, thereby almost halving the jetfuel prices on these routes.

The pricing method presently used by OCC for fixing prices of jetfuel is likely to be given up by public sector companies on deregulation which could be earlier than the scheduled year 2002. Prices would be based on (but not necessarily equal to) landed import prices both for domestic and international airlines. This would require that subsidies on LPG & kerosene be funded through the general budget and not by the current impost of surcharges on jetfuel (and Motor Spirit). Oil companies will need to adjust their domestic prices to recover such costs which they currently debit to the pool accounts while maintaining flexibility on international prices where a more competitive situation prevails.

Conclusions

Despite the announcement by Government in 1997 of a civil aviation policy for the country not much progress has been made. The disinvestment/privatisation of Air India and Indian Airlines still seems a long way off. Apart from the new international airport at Cochin, which is privately owned, no other private airport has been established though Government have very recently announced that 5 major airports will be given out on long lease. The issue of foreign airlines owning equity in private airlines in India was ruled out earlier but could still see a comeback. A new civil aviation policy is now expected in the year 2000.

The above notwithstanding, there has been a steady growth in jetfuel sales over the past few years and this is expected to continue in the future. Jetfuel sales doubled in the 18 years from 1981 to 1999 and are expected to double again in the next 10 years in the alternate scenario.

The capacity to manufacture jetfuel is in excess of demand and this is likely to continue through till 2010-11. Therefore there will be no need to import jetfuel, though in a deregulated scenario imports of all products including jetfuel should be permissible. Whether product imports will be an economic proposition will depend, inter-alia, on the extent to which Government provides duty protection to the Indian refining industry. In the case of jetfuel imports there will be a custom duty refund for international sales and therefore the level of duty protection on products may not be relevant.

The storage and distribution arrangements for jetfuel are owned by the PSUs and they provide hospitality arrangements too. If an importer wishes to bring jetfuel into the country (subject to what has been said earlier) it is unlikely that the existing oil companies will provide ullage/facilities to assist a competitor. However, there are few private parties that have put up product storage terminals at Mumbai, Vishakh and Kandla and they may be interested in switching their kerosene tanks/facilities to jetfuel subject to QC upgradation where required.

The opportunities for KPIAC to market jetfuel is dependent on several factors. With manufacturing capacity in the country continuing to be in excess of demand, the opportunities to import jetfuel at one location and swap for jetfuel deliveries at another location seems remote, though there may be niche opportunities. However, KPIAC's share of production from the proposed Paradip refinery does give opportunities to swap unlike products for jetfuel. A major issue, however, for a new entrant is creating the necessary infrastructure at the airports. BPC and HPC have been in the aviation business for many years but have found it difficult to expand their network. This is partly because at many airports more than one jetfuel supplier is not required and partly because land for a second supplier is just not available. The concept of shared storage facilities or a single operator for the oil industry (other than where there is a hydrant system) has not materialised and with IOC wanting to protect its turf, is unlikely to take place unless airport authorities insist. Privatisation of airports may make this happen.

Further, if KPIAC is able to put up or share in AFS facilities it should be in a position to persuade some airlines, which it is servicing abroad, to switch to KPIAC in India.

1

The history of civil aviation in India

.1 Introduction

The 1990s saw India integrating with the rest of the world. It was for the first time after India gained independence that the country threw open its gates to the world. A wave of liberalisation began, the Indian economy opened up and, with it, transportation and communication became the all-important services. Aviation, thus, became a crucial infrastructure sector, for now it was not simply a mode of transportation for the rich and elite. It became the all-important medium for trade and tourism; a revenue-earner for the economy in ways more than one. However, it was actually much earlier that the aviation industry in India found its foundation - in the year 1932, a time when the country was still in foreign hands. Since then the aviation industry has grown from a nascent industry to a sound infrastructural sector.

.2 The growth of Civil Aviation

It was a private initiative that gave birth to the civil aviation industry in India. J.R.D.Tata, the father of civil aviation in India, laid the foundations of the industry by setting up Tata Airlines, soon after piloting India's maiden civil flight from Karachi to Bombay enroute to Chennai on October 15, 1932. In the next fifteen years, the industry expanded its route network covering almost the entire India. Five airlines, apart from the Tata Airlines were allowed to take root, regulated of course by the British Government. The onset of World War II in 1939 had an indirect positive impact on the Indian civil aviation sector in that it helped in hastening the creation of airport infrastructure in the country. New airfields were set up and new routes were chalked out.

The post war civil aviation scenario was visualised by then Director General of Civil Aviation, Sir Frederick Tymms. He initiated what is known as the 'Tymm's Plan', with an aim to provide safe and orderly development of the aviation industry in India. The plan stressed the need to ensure financial viability of the scheduled air services before issuing them licenses. To meet this end and also to ensure the efficient and economic use of the infrastructure, formation of an autonomous Licensing Board was recommended. This was to allow only a limited number of private airlines to secure licenses for operating scheduled services.

Meanwhile, in August 1946, Tata Airlines was converted into a public company under the name of Air-India Ltd., with J.R.D. Tata as its chairman. The airlines then embarked on a major expansion programme, seeking rights to operate internationally. The government acceded to this request but only after acquiring a 49% stake with the option of snapping up a further 2% at a later date. By 1952, the government had acquired a 51% stake in the airlines. In March 1953, the Parliament passed the Air Corporation Act, taking over 25-odd domestic airlines and amalgamating them to form Indian Airlines. Simultaneously, Air India Ltd. was converted to a public corporation and named Air India. The civil aviation sector became a monopoly of the state with Indian Airlines catering to the domestic sector and Air India operating on the international routes.

While this helped the sector in enjoying the economies of scale, the absence of any competition and delay in fund approvals by the centre stagnated its growth prospects. However, the natural increase in population and increase in purchasing power of the people ensured a significant increase in air-traffic over the years. To cater to the growing demand, Vayudoot was introduced in the year 1981 with the aim of bringing the far-flung areas of the nation on the air-map of the nation. However, these routes proved unprofitable and the airline saw its profitability diminishing below the sustainability level. It was eventually merged with Indian Airlines in the year 1993 even as low utilisation of both crew and aircrafts and high operating costs were eroding Indian Airlines profit margins. Air India was also steadily losing its share of international traffic to its foreign counterparts. In 1994, the two nationalised carriers were converted into public companies preparatory to the government divesting a fixed percentage of their equity towards the expansion plans.

1.2.1 Liberalisation opens the domestic market

1990s was the liberalisation era in the country. In 1993, private airlines were allowed to operate on domestic routes. This saw six new airlines in operation-Jet Airways, East West Airlines, Damania, Modiluft, NEPC and Sahara Airlines. Regional players such as Archana Airways, Jagson Airlines, Gujarat Airways, Maharashtra Spanair, VIF Airways, Skyline NEPC, UP Air and India International Airways never made economical sense and hence most of these carriers had to terminate operations. By 1996, three major operators viz., East

West, Modiluft and Damania had bowed out. Damania was sold to NEPC in mid-1996, which itself was declared sick by early 1997.

Table 1.1 gives the traffic handled in the domestic sector by scheduled domestic airlines in the year 1996-97.

Table 1.1 Traffic of scheduled domestic airlines for the year 1996-97

Scheduled Services	Archana Airways	Jet Airways	NEPC Airlines	Sahara Airlines	Skyline NEPC	Indian Airlines
Passengers Carried (in '000)	16	2370	300	314	475	6,122
Capacity Utilised (RTKMs)	408	192,111	9,523	28,063	42,059	554,409
Capacity Available (ATKMs)	702	299,340	14,090	75,174	62,143	857,566

RTKMs.:Revenue Tonne Kilometres
ATKMs:Available Tonne Kilometres

Despite the fact that Skyline NEPC and NEPC Airlines were doing well, these airlines had to terminate their operations. They had acquired their aircraft through leasing with exorbitant charges. This made economic operations impossible. Also, they had ageing fleet, which meant increased cost of operations. In addition, their fleet capacity utilisation remained at below optimal levels. High operational costs, lack of adequate number of aircrafts and facilities and the DGCA directives to operate on uneconomical routes brought their closure. Thus, by end-1997, only two private operators reported profits-Sahara Airlines and Jet Airways.

1.2.2 *Foreign carriers take over the international market*

On the international front, Indian Airlines supplements Air India services by catering to as many as 17 international destinations. Despite the government making it mandatory for all government and public sector undertaking officials to use the national carriers as their first option for air-travel, AI and IA together command only about 29% of the market for international passengers today. The international traffic on scheduled services of Air India and Indian Airlines combined for the past three years is as summarised in Table 1.2.

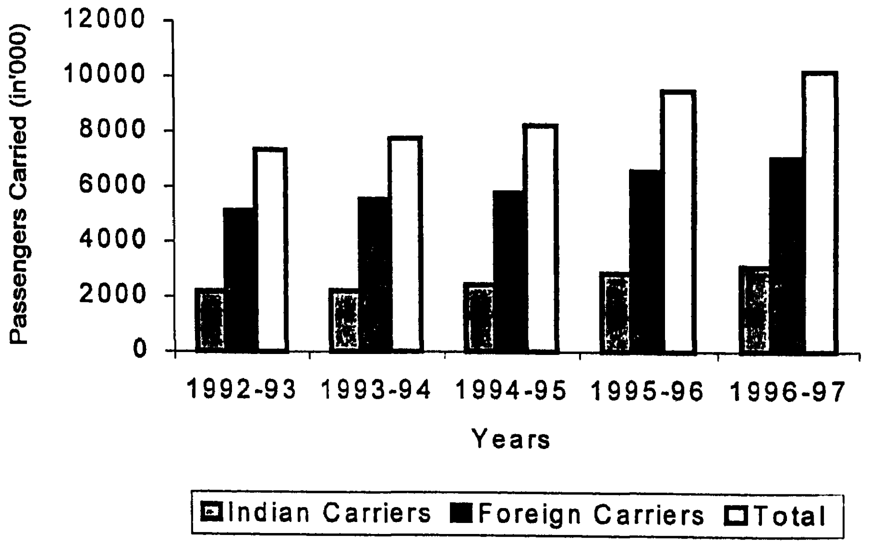
Table 1.2 International traffic on scheduled services of Air India and Indian Airlines for the past four years.

Traffic	1994-95	1995-96	1996-97	1997-98
Passengers Carried(in '000)	2,591	3,094	3,296	3,436
Capacity Utilised (RTKMs)	1,423,360	1,668,810	1,560,088	1,576,900
Capacity Available (ATKMs)	2,217,086	2,503,756	2,430,394	2,339,614

RTKMs.:Revenue Tonne Kilometres
ATKMs:Available Tonne Kilometres

The international carriers as Lufthansa, KLM, Swissair, SAS, British Airways, Air France, etc. from the west and JAL, Thai Airways, Singapore Airlines, Cathay Pacific, etc. from the east have catered to the maximum international travel to and from India. Therefore, though the demand for air travel picked up during the '90s, the national carriers continued with their dismal performance. Figure 1.1 summarises the trend of international air traffic to and from India and the share of both the Indian and the foreign operators in the same.

Figure 1.1 Annual growth of scheduled international traffic to and from India during the last five years.



In 1996-97, while the foreign operators carried a total of 7 million passengers and about 0.3 million tonnes of freight to and from India, the figures for the national carriers were 3 million passengers and 80,000 tonnes respectively.

1.2.3 *Continuing growth of the civil aviation sector*

Despite the poor performance by the national carriers, the civil aviation sector as a whole did reasonably well. Table 1.3 gives the growth of the civil aviation sector till 1997-98. Since 1984, the industry has shown an average growth rate of about 8% per year. The total passengers carried on international carriers reached 10.89 million and those by the domestic carriers were 12.06 million in 1998-99. Owing to the 'Open Skies Policy[a]' of 1993, the cargo traffic in 1998-99 amounted to 521,000 tonnes as against 228,000 tonnes in 1984-85. The aircraft fleet of the country as a whole stood at 105 aircrafts at the end of the year 1995. As per the forecast given by Airbus Industries, the air traffic in India is expected to grow at 5.3% every year for the next 20 years. This means that the number of aircrafts in India will increase by 3.9% from 114 aircrafts (in 1998-99) to 224 by the end of 2018.

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[a] Open Skies Policy, first initiated in 1992, facilitates cargo operations to and from India. Favourable consideration is given to private operators, association of exporters, etc. to run air cargo operations. Carriers are free to charge rates according to the demand and supply

Table 1.3 Growth of civil aviation

	1980-81	1985-86	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Total fleet strength (in No.)										
Air India	17	17	24	24	22	26	26	26	28	28
Indian Airlines	49	54	59	55	57	53	58	55	52	52
Vayudoot	@	3	17	17	16	#	#	#	#	#
Other Airlines**	-	-	-	-	-	19	21	22	27	34
Passengers handled at (million)										
Domestic Airports	NA	NA	NA	NA	7.7	9.9	11.1	12.2	11.7	11.6
Intl. Airports	NA	NA	NA	NA	7.3	7.7	8.2	9.4	10.2	10.7
Cargo handled at (thousand tonnes)										
Intl. Airports	NA	228	343	447	583	591	402	394	428	521
Airports & civil enclaves (in No.)										
	84	92	117	117	117	117	120	120	120	120

@-Aircraft leased from Indian Airlines
#-Vayudoot stands merged in Indian Airlines
NA-Not Available
**-Includes domestic scheduled airlines other than IA and AI.

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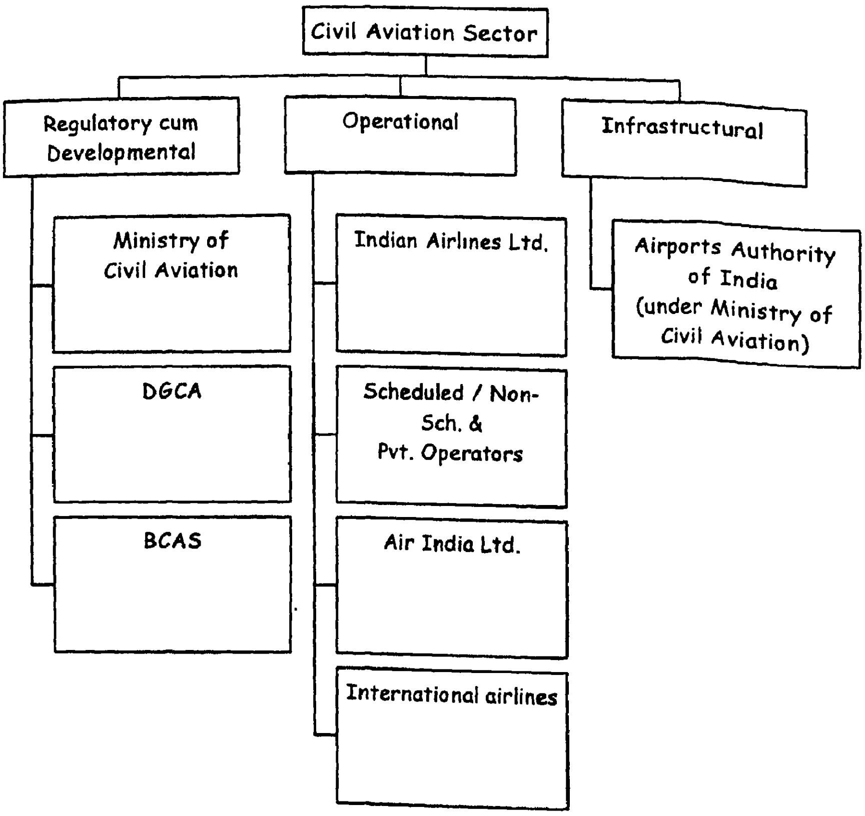
situation. Cargo flights into India are also permitted. Facilities for efficient clearance of the cargo from the airports are also made available under this policy.

1.3 Functional entities

The aviation industry in India is categorised into Defence and Civil sectors. The focus of the study is on the civil aviation sector. The civil aviation sector is broadly categorised into three distinct functional entities as follows.


Civil Aviation Sector
Regulatory cum Developmental
Operational
Infrastructural
Ministry of Civil Aviation
DGCA
BCAS
Indian Airlines Ltd.
Scheduled / Non-Sch. & Pvt. Operators
Air India Ltd.
International airlines
Airports Authority of India (under Ministry of Civil Aviation)

1.3.1 Regulatory and developmental functions

The regulatory functions are looked after by the Ministry of Civil Aviation, the Directorate General of Civil Aviation (DGCA) and the Bureau of Civil Aviation Security (BCAS).

The Ministry is primarily responsible for the formulation of national policies and for devising and implementing strategies for the development and expansion of the civil aviation industry in the country. It also has supervisory responsibilities, overseeing the provision of airport facilities, air traffic services, carriage of passengers and goods by air, etc.

The DGCA is responsible for the regulation of air transport services to, from and within India. The formulation of standards for civil aircrafts and the granting of certificates, registration of the civil aircrafts, licensing of pilots, aircraft engineers, maintenance crews, licensing of aerodromes in India and coordination of regulatory functions are among the primary functions of the DGCA.

Airport security is looked after by specialised police agencies, state police and airport security organisations, depending upon the internal security conditions prevalent in a particular area. BCAS co-ordinates the working of various security agencies to ensure that all security norms are being adhered to.

1.3.2 *Operational functions*

The operational functions are those performed by the air-carriers viz., Air India Ltd., Indian Airlines Ltd., Pawan Hans Helicopters, other scheduled/non-scheduled airline operators and the international carriers operating to and from India. While Air India provides international services to and from India, Indian Airlines and other scheduled/non-scheduled operators cater to the domestic air demand. Indian Airlines also operates on international routes to some of the neighbouring countries. Many international airlines as KLM, Lufthansa, British Airways, Thai Airways, etc. also cater to international traffic to and from India. Pawan Hans Helicopters are government owned and provide services primarily to the petroleum sector.

1.3.2.1 The domestic carriers

Indian Airlines

The entry of private airlines in the '90s shook Indian Airlines from its complacency. The number of passengers was rising but not the airlines' capacity. Also, with the grounding of 18 Airbus A-320 planes for 10 months during 1989 following an air crash in Bangalore the same year and the amalgamation of Vayudoot with it in 1993, the airline ran up losses in excess of Rs.6000 million during the period 1988-89 to 1992-93. The government in 1988 to serve the feeder routes initiated Vayudoot. However, by 1991 it was declared sick with losses amounting to Rs.1500 million and was transferred to Indian Airlines in 1993. The mass exodus of trained personnel of the airline lured away by the newly arrived private airlines was yet another blow to the carrier. Also, as per DGCA guidelines, as part of the social obligations, the uneconomical routes in North East and Jammu & Kashmir also have to be catered to by all domestic (national, scheduled/non-scheduled and private) carriers, thereby further denting the revenues.

Indian Airlines witnessed a negative growth of (-) 1.34% and (-) 8.28% in capacity and traffic, respectively during the period 1992-93 to 1997-98. The share of the airline in the domestic market declined, the decline concentrated mainly on the trunk routes with private airlines capturing almost half of this market. Presently the market share of Indian Airlines is around 55%.

Indian Airlines' subsidiary, Alliance Air, serves low-traffic domestic feeder routes and operates Boeing737-200 services. IA possesses today, in total, a fleet of 11 A300s, 12 Boeing 737s and 30 fly-by-wire A320s. From 0.5 million in 1954-55, the passengers carried by the airlines reached 8.4 million in 1997-98. Its network now covers an expanse of 1,18,000 kilometres (1997-98) while the seating capacity has been augmented to 35,700 seats per day. After incurring continuous losses for 8 years, the company made a profit of Rs.473 million during the year 1997-98.

A committee of experts has suggested a set of measures so that the current market share of Indian Airlines is maintained in the future as well. It has recommended that the government make a fresh equity injection of Rs.1250 million for the carrier's upgradation. The government's shareholding at the same time will be brought down to 49%. The process of disinvestment is likely to be propelled by the civil aviation policy due to be announced in January 2000. In the ninth plan period, Indian Airlines is also planning to replace some of its old A300s and Boeing737 aircrafts within the next three years.

To perk up its revenue, IA is also planning to purchase an Automated Revenue Management System (ARMS) that will allow it to introduce flexible fares for both international and domestic sectors. This will include introducing different fares in the same class of travel by means of lower fare for the 'early birds' and slightly elevated ones for the 'last minute' ones.

Other Domestic Carriers

Currently, there are 6 scheduled[b] and 22 non-scheduled operators in the domestic aviation scenario. Besides Air India and Indian Airlines, the private operators Jet Airways and Sahara Airlines cater to domestic routes. High passenger load plus the increase in airfares by end-1997 has helped these airlines to realise modest profits. Together, they have managed to corner around 40% of domestic air traffic since 1997. Figure 1.2 gives the domestic air traffic share commanded by these airlines vis-à-vis Indian Airlines.

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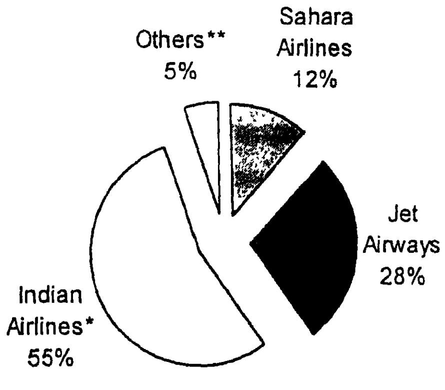
[b] Lufthansa Cargo India and Airline Allied Services Ltd. are the other two scheduled operators besides Air India, Indian Airlines, Jet Airways and Sahara Airlines.

Figure 1.2 Proportional share of scheduled operators in domestic air traffic.



*Indian Airlines also include its subsidiary Alliance Air services.

** Others also include traffic catered to by Air India.

Over the years, Jet Airways has improved its performance spectacularly. From a three aircraft fleet in 1993, today, Jet Airways has 25 aircrafts. Sahara, on the other hand, has a modest fleet of 9 aircrafts though it is planning to induct another Boeing aircraft and twelve Embraer soon enough. Though Jet Airways has clearly established a lead over the former, Sahara has recovered from a fatal crash at Delhi airport in and performed well mid-1996 onwards.

Infact, Sahara Airlines is all set to give a stiff competition to both Indian Airlines and its arch-rival Jet Airways in the new millennium by pegging its fares 10% lower. The airline has already reduced its fare on some of the key routes. In addition, it is also planning to launch new value-based services and more schemes to attract the domestic air traveller. The airline is also planning to increase its flight frequency on key routes, especially those that have been the stronghold of its rival airlines.

Improved services and revised fares may give a boost to the domestic air travel as with increasing disposable incomes and decreasing fares, more and more people would be able to afford domestic air travel.

1.3.2.2 The international carriers

Air India

Air India has seen a steady decline in its international market share over the years. From 30% in the 1960s to 25% in the '70s and then to 18% in the 1990s, the airline has been losing its share to other foreign players. Except for a profit of Rs.3330 million in 1992-93, it has since suffered continuous losses. Though it kept expanding in proportion to the rising demand yet it grossly under-utilised the bilateral traffic rights it had acquired from various foreign countries in exchange of similar rights to the carrier of that country. Air India's Gulf operations, the most profitable route for the carrier, has been adversely affected due to new entrants. The carrier's passenger load factor for this sector came down from 64.7% in 1992-93 to 57.9%in 1995-96. The losses on the Europe sector were to the tune of Rs.1880 million in 1995-96 owing mainly to the fall in the value of the Indian rupee as also the relative preference for Europe's airlines.

On the other hand, there has been an increase in its operational costs as the company tried to match its capacity (increased by 24.27% over the period 1991-92 to 1995-96) with the growth in traffic (increased to 29.25% over the period 1991-92 to 1995-96). Thus, together, the increase in operational costs, depreciation in the value of the Indian rupee and the increase in competition has resulted in a reported loss of Rs.1,810 million in 1997-98 by the airline.

Presently, the company has a fleet of 9 Boeing 747-200s, 2 Boeing 747-300s, 6 Boeing 747-400s, 8 Airbus A310-300 and 3 Airbus A300-B4s. Its fleet consists of five types of aircrafts having varied capacity and features. The airline is planning to standardise its fleet to three types of aircrafts in the future. As part of its short–term fleet expansion, it is planning to induct three Airbuses 300 in its fleet. Connectivity being the buzzword, Air India is now planning to induct more of SCSRs (short capacity short range) and SCLRs (short capacity long range) as against its previous plan of inducting MCLRs(medium capacity long range).

Currently, the airlines' depleting fleet is proving to be a major hindrance to its profitability. Owing to the shortage of aircraft, the carrier has curtailed its air services to places like Germany, Manchester and Rome. Instead it has entered into code sharing agreements with the foreign carriers plying on these routes. Thus, it has obtained rights to sell tickets on another airline's flight. Though this measure helps in revenue generation for the carrier, in the long run it hampers the prospect of the airline's own development.

India-London is one of the most profitable and also a heavy traffic route. The Indo-UK sector can sustain well over 40 flights a week. The bilateral agreement between India and the UK supports 16 flights per week by each of the country's carrier. While British Airways is utilising its capacity to the fullest by operating 16 flights a week, Air India has only 10 flights per week plying on this route. Similarly, the bilateral agreement between Germany & India allows for 15 flights per week each by designated carriers from the two countries. While, Lufthansa uses its bilateral rights to the fullest potential, AI has stopped plying on this route altogether. Thus, for the carrier to generate profits, the Air India fleet needs to be reinforced.

Recently, Virgin Atlantic Airways, a UK based airline, has proposed a code-sharing alliance with Air India. The airline has demanded seven flights a week between India and London and has also offered code sharing with AI on flights to the United States. The DGCA expects a 30% jump in traffic on the Indo-UK sector if and when Virgin begins its operations. Further, the airline has also proposed co-operation with AI in some of the aviation activities such as yield management, airport and cargo handling and frequent-flier programmes among others. Interestingly, it has also shown interest in picking up stakes in AI once the disinvestment process starts. However, it is believed that the divestment of AI maybe delayed owing to the lack of required funds with the centre. Additionally, the Virgin Airways is already probing possibilities of a tie-up with a domestic carrier to feed incoming passengers to other Indian cities. This, in effect, may lead to increased competition in the domestic arena too.

Other international carriers

Air India and Indian Airlines have been steadily losing their share of international traffic to the foreign counterparts. Table 1.4 gives the flight frequency of international carriers for the various destinations.

Table 1.4 Flight frequency and destinations catered to by international carriers.

Destinations catered to by carriers flying from India	Carriers plying between India and the airport	No. of flights per week
Europe		
London	Air India	10
	British Airways	16
Paris	Air India	5
	Air France	11
Amsterdam	Air India	1
	KLM	7
Frankfurt	Lufthansa	15
Copenhagen	SAS	5
Zurich	Swiss Air	11
Vienna	Austrian Airways	3
Far East		
Japan	Air India	7
	JAL	2
S.E.Asia & Australia		
Bangkok	Air India	1
	Cathay Pacific	4
	Thai Airways	8

Destinations catered to by carriers flying from India	Carriers plying between India and the airport	No. of flights per wee
Hongkong	Air India	6
	Cathay Pacific	2
Singapore	Air India	11
	Singapore Airlines	23
Jakarta	Air India	3
Sydney	Quantas	7
Middle East		
Abu Dhabi	Air India	7
Kuwait	Kuwait Airways	4
Muscat	Air India	5
Dubai	Air India	17
	Cathay Pacific	4
	Emirates	27
Africa		
Mauritius	Air India	7
Nairobi	Air India	1

Note Table does not include Indian Airlines destinations.

While Air India has curtailed its flights to some destinations as Manchester, Germany and Rome owing to its fleet constraint, Lufthansa, Air France and British Airways have increased their flight frequency to and from India. This is done in line with the bilateral agreements that govern the growth of air services of the respective national carriers between the two countries.

On the downside, however, a few of the foreign carriers viz., Air Canada, United Airlines, Taron (Romanian airlines) etc., had to close shop in India since the route they catered to did not generate enough traffic to make profits.

1.3.3 Infrastructural functions

The Airports Authority of India looks after the infrastructure facilities. The Airport Authority Act, 1994 merged the two airports authorities viz., the International Airports Authority of India (IAAI) and the National Airports Authority (NAA) into a single unified body i.e., the Airports Authority of India (AAI) w.e.f. 1st May, 1995. It is responsible for the management and development of all the airports, both national and international, in India. The Authority is also responsible for providing navigational facilities to the aircrafts operating in India.

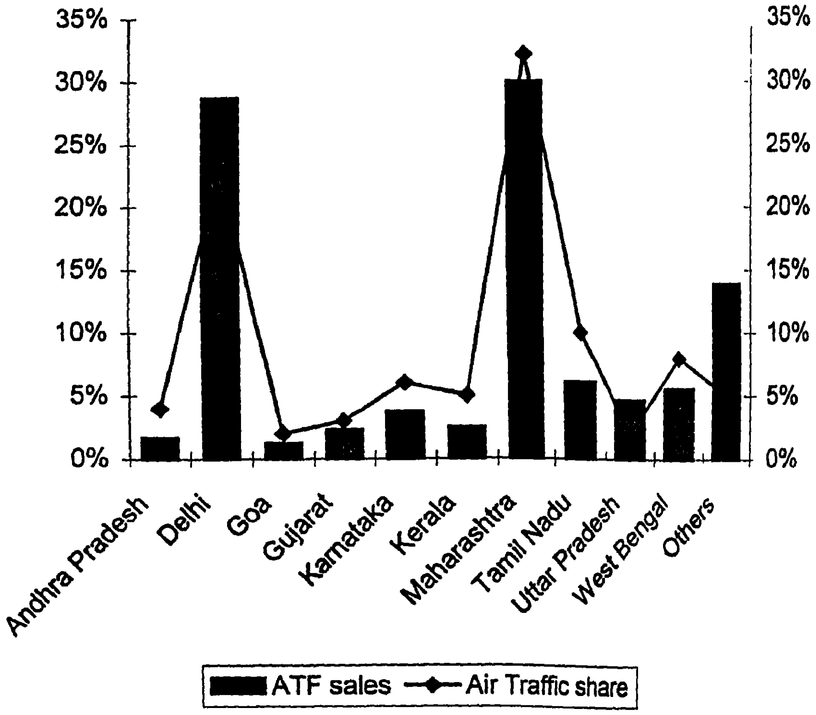
There are a total of 449 airstrips/airports in the country of which AAI manages a total of 120 airports; 61 of these 120 airports are in use by airlines at present. Besides the six international airports at Delhi, Mumbai, Chennai, Calcutta, Cochin and Thiruvanthapuram, there are 86 domestic airports and 28 civil enclaves. The latter are essentially defence airfields also allowed to be used for civilian flights. Cochin, a private venture, has been the recent addition to the list of international airports of the nation. The Cochin International Airport Ltd. (CIAL) was set up by a company whose main shareholders are the state government, Bharat Petroleum Corporation Limited, Housing and Urban Development Corporation Ltd. (HUDCO), a consortium of banks, some Gulf based NRIs and the Airports Authority of India.

While the top five airports at Delhi, Bangalore, Mumbai, Chennai and Calcutta handle nearly 75% of total air-traffic, the next ten airports at Hyderabad, Thiruvanthapuram, Goa, Ahmedabad, Guwahati, Cochin, Kozhikode, Jaipur, Varanasi and Nagpur account for nearly 16% of the traffic. The remaining 46 airports handle on an average two aircraft landings per day.

In 1998-99, these 120 airports handled 423 thousand aircraft movements involving 12.06 million domestic and 10.89 million international passengers, and 0.2 million metric tonnes of domestic and 0.5 million metric tonnes of international cargo movements. In order to handle increasing international traffic, the government has created 'custom areas' in nine airports viz., Hyderabad, Bangalore, Calicut, Ahmedabad, Goa, Varanasi, Amritsar, Tiruchirapally and Patna. These airports called the 'custom airports', have custom and immigration facilities for limited international air movements by national carriers and for foreign tourist and charter flights. Airports like Lucknow, Bhubaneshwar, Guwahati, Nagpur, Vadodara, Coimbatore, Imphal and Indore are the 'model airports'; having a minimum runaway length of 7500 ft. and adequate terminal capacity to handle Airbus 300 type of aircrafts.

The international traffic is restricted to the cities sporting an international airport. The international traffic, in turn, gives boost to the domestic air traffic in the region. Therefore, the growth in air traffic in a region is dependent on its connectivity with the rest of the nation and the world at large. The air traffic, in turn, drives the sale of the Aviation Turbine Fuel (ATF). In 1996-97, the top five, ten and fifteen airports handled 76%, 87% and 91% of the total traffic respectively. As a result, the top ten states (in terms of air traffic) handled 95% of the total air traffic. All other states and union territories together accounted for a mere 5% of the total traffic. Therefore, the major demand for the aviation fuel arose from the states of Maharashtra and Delhi. The results are summarised in the graph below.

Figure 1.3 Percentage share of states in air traffic and jetfuel sales for the year 1996-97.



1.4 The National Civil Aviation Policy 1997

Uptil 1997, the government's policies for the civil aviation sector were inward looking. Though the monopoly of the national carriers was broken with the entry of the private operators, yet the policies continued to favour and protect them. Private operators were wary of the fallouts of the policy that a decision taken by one government maybe undone by the next, was one constant fear among the private investors. Also, with the instability at the centre, there was always a fear of political interests taking precedence over aviation sector considerations. Lack of transparency in policy formulation also deterred private investors from investing in the aviation infrastructure.

For instance, the Tata Singapore Airlines project, under which the duo had proposed to start a domestic airline, was fully in tune with the 1993 civil aviation policy of permitting 40% equity in domestic airlines. However, in 1995, since the year's civil aviation policy had not been formulated by the time when the proposal was tabled and it was not clear whether foreign equity in domestic airlines would be permitted in the new policy, the proposal was rejected. Once the policy was announced, the Tatas changed their proposal and decided to float a civil aviation company with 60% stake held by the Tatas and the remaining 40% by foreign institutional investors. Though approved by the FIPB, this proposal awaited final approval by the central government, failing which it got shelved. Had this proposal been cleared, it was believed that given the project's proposed size of operation, the entire domestic aviation industry would have been stirred to action.

1.4.1 *Policy for airlines*

As per the civil aviation policy announced by the government in 1997, foreign equity upto 40% and investment by NRIs or overseas corporate bodies' upto 100% will be permitted in domestic air transport services. However, equity from foreign airlines will not be allowed directly, or indirectly, in domestic air transport services. Existing companies in which such equity exists will be advised to disinvest this equity. The other notable features include-

- Removal of all entry and exit barriers. There would only be a scrutiny of applications to verify financial soundness and maintenance, security and safety aspects of operations.
- The choice of aircraft type and size is left to the operator.
- To achieve economies of scale, the minimum fleet size for a scheduled operator has been raised from the existing three aircraft to five. Also the minimum amount of shareholders' funds has been increased from the existing Rs.50 million to Rs.100 million for aircraft of all-up weight below 40,000 kg. and from Rs.100 million to Rs.300 million for all-up weight exceeding 40,000 kg.
- Total capacity requirements in the air transport sector are being projected for a period of at least five years on an annual basis to help the developer make investment decisions.
- In the distribution of this capacity, while preference will be given to Indian Airlines according to its fleet augmentation plan, private operators' proposals to induct new capacity will be considered based on the demand, load factor, past track record and financial soundness. This, in turn, implies strict controls on capacity increases by private carriers to check against over-expansion.
- All scheduled operators are required to deploy 10% of their capacity in Northeast India, Jammu & Kashmir, the Andaman and Nicobar Islands, and the Lakshadweep islands.

1.4.2 Policy for airport infrastructure

Until 1997, AAI had been the sole provider of aviation infrastructure in the country. Its International Airports Division (IAD) managed, operated and worked for the development of the six international airports of the country while the National Airports Division (NAD) looked after the domestic airports, including their modernisation and upgradation. The government since the beginning had the monopoly in building and maintaining all the airports of the country. But seeing the growth in air-traffic (both current and predicted) and also the amount of investment required for the infrastructure, the government changed its policy.

In 1997, in addition to the National Civil Aviation Policy, the government also came up with a policy on airport infrastructure. Under the new scheme, airports can be owned and managed by the centre, public sector undertakings, state governments, urban local bodies, private companies and/or joint ventures. As per the policy,

- There is to be a reclassification[c] of airports as international hubs, regional hubs and other operational airports.
- Accordingly, no greenfield[d] airport will be taken up either in the public or private sector without the prior permission of the government.
- Priority will be given to expeditious clearance of cargo from the airports as also to safety and passenger facilities with respect to the fund allocation for modernisation and upgradation of airport facilities.
- A greater civil-military liaison for joint surveillance of Indian airspace is envisaged.
- Ground facilities would be improvised upon to bring in speed and efficiency.
- The policy aims to exploit revenues from commercial activities, both existing and potential. Privatisation and corporatisation of airports is suggested to bring them to the international standards.

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[c] International Hubs cover airports currently classified as international airports and those eminently qualified to be upgraded as such. Regional Hubs would handle regional airlines and also have the facilities to handle limited international traffic. The current model airports will fall under this category.
All other operational airports not included in the above two categories will come under the third one.

[d] A Greenfield airport will not be permitted unless a new focal point emerges with sufficient traffic to justify a new airport or at a place where the existing airport is unable to meet the demand. Permission from the government or DGCA (in case of Other operational airports) is mandatory.

- Foreign equity participation is permitted with automatic approval upto 74% and upto 100% with special permission. This would also help in commercialisation of marginal or loss-making airports.
- Environmental aspects will also be considered in relation to the airport operations. The airports would be set up after the requisite environmental clearances for the same.

The policy envisages the setting up of an airport approval commission as an independent statutory body, the aim of which being to examine fresh proposals for airports. Also, the setting up of an airport restructuring committee was recommended that would identify the existing airports that could be developed aided by the private sector.

The AAI plans to raise funds from internal resources to finance the upgradation and modernisation plans at the various airports. In addition, the Authority plans to net some additional revenue by increasing the landing tariffs for the aircrafts. Once the proposed hike in landing [e], parking and navigation charges by the AAI is approved by the IATA and enacted, the authority will earn additional revenue of Rs.300 million. The increase in both passenger and cargo traffic in the coming years would also contribute to the financial health of the sector. More revenue also needs to be mopped up from the commercial exploitation of the airports like restaurants, cargo complexes, duty-free complexes, etc. All this extra revenue would be required for the navigation equipment modernisation programme at the major Indian airports. AAI has budgeted Rs.35,000 million as funds requirement for airport development in the current plan period.

1.5 Future prospects

1.5.1 The airlines front

In line with the announced policy measures and those anticipated from the yet-to-be announced 1999-2000 policy, various airlines have been spurred into activity. Currently, 7 scheduled private operators and 22 non-scheduled operators are allowed to operate air services. However, Modiluft and East West are trying to get air borne again. While the former has asked for a comprehensive airline management package from Speedwings Consultancy(a British Airways subsidiary), the latter had approached the DGCA for its license renewal. As per DGCA, four new carriers viz., Deccan Airlines, TransIndia Airlines, Assured Airways and Maharishi Industrial Business have already obtained permission to begin operations. Private airlines like Jet Airways and Sahara Airlines have sent a plea to the government to allow them to operate on international routes though no decision has been taken on this as yet.

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[e] **Airlines are charged landing fees according to the 'all-up' weight (including passengers on board) of the aircraft they operate. They need to pay for parking their machines on an hourly basis.**

The traffic in non-metros is increasing at a fast rate. Thus, the focus, at present, is to boost the connectivity between the metros and the other cities within the country. Infact, these non-metros are the new profit centres for airlines as these cities are now demanding direct global connectivity. Pune, Raipur and Vishakhapatnam are a few of the cities where air traffic seems promising. Since these routes are not being fed to the full capacity, Indian Airlines is planning to increase its flight frequency on these routes. However, to cater to these routes, the Indian Airlines must induct turbo-props in its fleet. Turbo-props are smaller aircrafts that make more economical sense for shorter routes than its bigger counterparts.

Envisaging still greater competition in the future, to match the growing competition, Air India plans to enhance its marketing image and hence majority of its efforts will be concentrated on improving its product and time performance. It also strives to increase its market share through code sharing and strategic alliances. The government is already expanding its scope of code-sharing deals by entering into pacts with Trans World Airlines and Royal Jordanian Airlines. This would earn the cash starved Air India some immediate revenue.

1.5.2 Airport infrastructure

Upgradation/capacity augmentation

On the infrastructural front, as indicated by the policy, modification and development of airport infrastructure is high on the agenda of the Government. One of the most significant initiatives by the government in the coming times would be its proposal to give five major airports including Delhi, Mumbai, Calcutta, Chennai and Bangalore on a long term lease to private companies. Though these five airports would be offered on lease but it is not yet clear whether the tenure should be 20 or 30 or 50 years. The lease would be either directly used for subsidising the loss making airports or it could be given as a consolidated fund to the government which would then be passed on to the airports for their upgradation and maintenance. The decision to lease, is in contrast to the earlier decision to corporatise the five major airports. The task force on infrastructure, however had suggested that leasing is a better option.

They are also discussing the idea of setting up a regulatory body for aviation and are finalising the financial and legal contractors for the leasing of five international airports. In fact, it is also proposed that seven airports including Bangalore, Guwahati, Cochin, Hyderabad, Amritsar, Goa and Ahmedabad will get international status soon.

The Ministry itself has identified airports at Hyderabad, Goa, Guwahati, and Ahmedabad besides Amritsar for facilities upgradation. Private initiative is being sought for the construction of Jaipur airport's international block and upgradation of the Aurangabad, Mangalore, Guwahati and Cannanore airports. Capacity augmentation in passenger terminals at Mumbai, Calcutta, Thiruvanthapuram and Chennai is also proposed during the 9th Plan period. Construction of a cargo complex at the Chennai airport has also been given priority by the state government.

New airports

The proposal for a second international airport at Chennai has already met with approval from the central government and now awaits a nod from the AAI. This is a Rs.20,000 million venture by the DMK government, an initiative taken to ease the traffic at the existing Chennai international airport. Yet another strategy of decentralising traffic at the international airports being initiated by the civil aviation ministry is to boost the construction of five new international airports close to the existing five airports-Ahmedabad near Mumbai, Amritsar near Delhi, Bangalore and Hyderabad near Thiruvanthapuram and Cochin, and Guwahati near Calcutta.

The Cochin international airport is the nation's first private airport. Realising the potential for similar private sector initiatives, the central government is busy formulating the new aviation policy that should foster private sector participation in the industry. In the pipeline are a few of the private sector aided projects for Hassan (Karnataka), Mumbai, Goa and Bangalore. The Mumbai airport is to come up at Navi Mumbai.

The Karnataka state and the central government are taking up the Bangalore international airport project, which was in a limbo following the Tata's withdrawal, on an earnest basis. The Bangalore project is envisaged on the same lines as the Changi airport at Singapore. It will be equipped to handle one take-off and landing per minute, a never-before in India. Infact, the state government has already shortlisted seven private companies for the project which include the consortia of Reliance Industries, Hocktief of Germany, Siemens, Larsen &

Toubro, Asea Brown Boveri, British Airport Authority, Bechtel Corporation and the Dutch Schipol Airport.

Connectivity for international airlines

Gulf carriers like Emirates, Kuwait Airways and Saudia have approached the Indian government for permission to operate from Hyderabad, Ahmedabad, Goa and Calicut. Interest has also been shown by European majors like Lufthansa, KLM, SAS, etc. to make these cities as landing points apart from the existing international airports of the nation. At the moment, however, cities like Hyderabad and Bangalore are permitted only two international flights per week. But with the government's plan of upgrading most of these airports to international airports, much air-traffic activity is envisaged in these cities. At present, Hyderabad and Bangalore both enjoy a demand of 10 international flights a week.

The Karnataka government, with the aid of the private sector, is considering a proposal to build 'mini' airports in almost all the districts of the state. Plans are also underway by the state government to revive the Mysore airport. However, it is maintained that only small turbo-prop aircrafts can operate from this airport owing to its constrained capacity.

For popular tourist destinations like Goa and Rajasthan, there maybe part-financing of facilities through tax-paid by embarking international passengers. This scheme is currently being tried out at Kozhikode. It is expected that the revenue generated through this scheme will be used for upgrading facilities at these airports.

1.6 The New Civil Aviation Policy 1999-2000

The new national civil aviation policy is expected to be announced in the first quarter of the year 2000. Besides other issues, it will reflect the centre's view on Air-India and Indian Airlines as it is expected to be based on the Kelkar Committee recommendations on the disinvestment in Air-India and Indian Airlines. The major issues that are believed to be addressed in the policy are steps to make functioning of both the airlines economically viable in light of their present status and proposed future plans, putting significant emphasis on setting up of both international and national airports, examining the number of airports to be offered on lease, etc. It is believed that the policy would encourage greater private sector participation in the industry and would provide a level playing field to both the domestic and foreign players. This may mean that the protection the national carriers have been getting for long may just come to an end soon. The disinvestment process may be the first step in that direction.

It is imperative that this policy should deliver where its predecessors have failed. Unlike its predecessors, the new policy should be transparent and fair to both domestic and the international carriers. Deregulation of the aviation industry should be given priority. The funds accumulated through divestment should be reinvested in the industry. Also, both policies and facilities should be such as to favour investment in the industry. Taxes and other charges such as landing, navigational, etc. should be rationalised and be brought at par with the rest of the world. Private initiatives in the industry should not be subjected to bureaucratic interferences. This may require a setting up of a regulatory authority to ensure speedy disbursals of proposed plans and also their efficient implementation.

To help the industry get a better understanding of the current situation and also to aid corrective measures for the industry, the Confederation of Indian Industry (CII) has commissioned the study of the aviation industry to the National Council of Applied Economic Research (NCAER). The purpose of the study is to analyse the performance of the aviation sector and forecast its future prospects. NCAER is also expected to deliver a recommendatory draft civil aviation policy.

Besides this, the Ministry of Civil Aviation, in co-ordination with the DGCA, IA, AI and AAI, has set up a committee to review the short-term and long-term projections of growth in passenger and cargo traffic for both the domestic and international sector. This may help in improving the planning of airport facilities as also the air transport requirements.

All these initiatives, it is hoped, would help the Indian aviation industry in chalking out an accelerated growth track for itself.

2

Jetfuel demand projections

2.1 Introduction

The consumption of aviation turbine fuel (jetfuel) is accounted for by the requirements of the civil aviation sector and the defence forces. The former accounts for about 80% of the total sales of jetfuel in the country and the latter about 20%. Jetfuel consumption by international airlines in 1998/99 was 55% of the total sales while that by domestic airlines constituted only about 25%.

Table 2.1 Pattern of jetfuel Sales (1998/99)

Sector	*Percentage Sales of jetfuel*
International Airlines	55
Domestic Airlines	25
Defence Forces	20

Jetfuel is currently marketed by the three public sector oil companies, Indian Oil Corporation (IOC), Bharat Petroleum Corporation Ltd (BPCL) and Hindustan Petroleum Corporation Ltd (HPCL). Of the total trade of 2097 TMT in 1998/99, IOC accounted for about 70% of the sales while BPCL and HPCL commanded 22% and 8% share respectively.

For the purpose of this analysis, jetfuel demand has been analysed for the civil aviation sector only while estimates of the requirements for the defence forces have been proportionally derived on the basis of their current share in the total jetfuel demand.

While fuel requirements for domestic operations of Indian carriers are met completely from indigenous sources, the international carrier, Air India sources jetfuel from other countries as well. Due to the relatively higher jetfuel prices in India, Air India uplifts only 30% of its total fuel requirements from India. Due to the cost differential other international airlines like British Airways, Lufthansa, etc. also refuel the minimum required quantity of jetfuel in India.

Trends in passengers traffic, domestic and international, along with those in jetfuel sales in the country are presented in Table 2.2. Figure 2.1 presents a comparative index of operations in the civil aviation sector in terms of passengers carried, international and domestic (scheduled services only; Base 1992/93 =100) and jetfuel sales in the country.

Table 2.2 Jetfuel sales (TMT)

Year	*Passenger Traffic*		*Jetfuel Sales**
	International	*Domestic*	
	(Millions)		*(TMT)*
1992/93	7.32	7.66	1565
1993/94	7.73	9.94	1741
1994/95	8.18	11.06	1903
1995/96	9.41	12.19	2082
1996/97	10.17	11.70	2167
1997/98	10.66	11.55	2118
1998/99	10.89	12.02	2097

* Inclusive of sales to defence

Figure 2.1 Index of operations & jetfuel consumption (Base 1992=100)

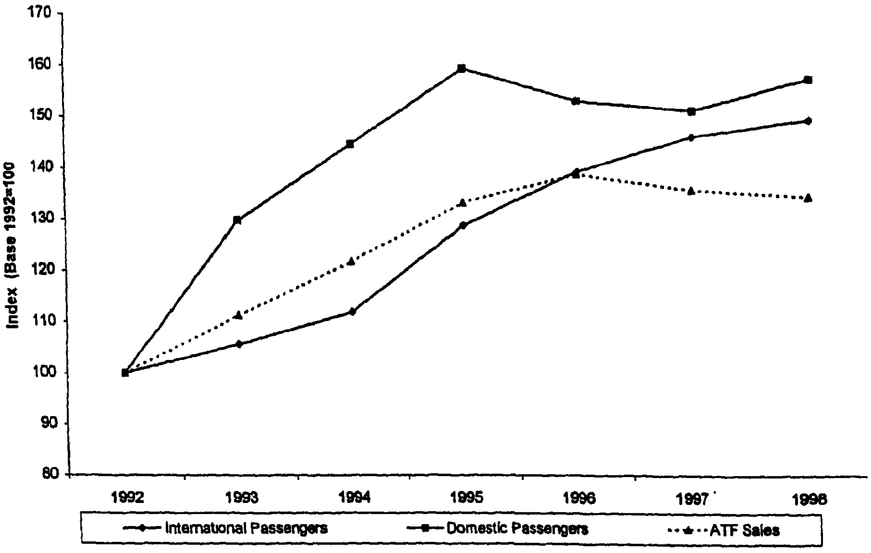


Figure 2.1 indicates that the jetfuel sales peaked in 1996/97 and have declined thereafter. Bulk of the jetfuel sales are accounted for by the international airlines and a gradual deceleration in the growth in international traffic has led to a decline in jetfuel demand from this sector (Table 2.3).

Table 2.3 Jetfuel sales to international and domestic [Domestic civil aviation & defence] (TMT)

Year	International	Domestic	Total
1994/95	975	928	1903
1995/96	1066	1016	2082
1996/97	1156	1011	2167
1997/98	1131	987	2118
1998/99	1136	961	2097

The variations in jetfuel sales arise primarily form the trends in the domestic passenger traffic. There was a boom in the domestic sector in 1993/94 with the entry of private airlines. The ensuing period, thus, witnessed a high demand growth for jetfuel to the tune of 10% per annum over the period 1992/93 to 1995/96. This trend was arrested in 1996/97 with a decline in the domestic passenger traffic. The bulk of the domestic air traffic being accounted for business travel, the decline in the domestic passenger traffic could be attributed to the deceleration in industrial growth rate from 12.8% in 1995/96 to only 6.2% by 1997/98. The period, thus, witnessed a shakeout in the domestic sector with airlines like Modiluft and East West Airlines closing shop. Jetfuel sales in 1996/97 witnessed only a 4% growth over the previous year and those in 1997/98 declined by 2.3% due to a continued drop in domestic passenger traffic.

In 1998/99, jetfuel sales to the international airlines increased marginally (Table 2.3) while those to the domestic sector (inclusive of defence) declined. Given the fact that the passenger traffic in the domestic sector increased by about 4% in 1998/99 and that fuel for domestic civil aviation operations is sourced indigenously, it follows that the decline in jetfuel sales in 1998/99 is on account of a reduced requirement from the defence forces.

While exact figures for year-to-date sales of jetfuel in the year 1999/00 are not available, interactions of the project team with officials of the oil companies, revealed a declining trend in jetfuel sales in the current year as well. This has been ascribed to a number of international airlines suspending operations from India including United Airways and Air Canada.

2.1.1 Regional jetfuel sales

Jetfuel sales in the country are not uniformly distributed geographically. The Airports Authority of India manages 120 airports of which only six are international – Delhi in North, Mumbai in West, Calcutta in East and Chennai, Cochin & Thiruvanthapuram in South. The Cochin airport in Southern India started international operations only in May 1999. The five airports, excluding

Cochin, accounted for 71% of the total passenger traffic and 88% of the total freight in 1996/97.

With bulk of the sales being accounted for by international airlines, jetfuel sales are concentrated at international airports primarily, and of these particularly at Mumbai and Delhi. The Northern and Western regions, thus, together accounted for 73% of the total sales in 1998/99, with the former commanding 40% of the total sales and the latter 33%. The report on jetfuel consumption at the ten major airports, identified in the terms of reference for the study, is included in Chapter 5.

Table 2.4 Region-wise jetfuel sales (TMT)

Region	*1995/96*		*1996/97*		*1997/98*		*1998/99*	
North	906	44%	913	42%	881	42%	833	40%
South	284	14%	304	14%	367	17%	382	18%
East	179	9%	200	9%	196	9%	200	10%
West	713	34%	750	35%	673	32%	682	33%
Total	2082		2167		2118		2097	

Northern Region: Comprises the states of Delhi, Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Uttar Pradesh & the Union territory of Chandigarh

Southern Region: Comprises the states of Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and the Andaman & Nicobar Islands

Eastern Region: Comprises the states of Arunachal Pradesh, Assam, Bihar, Manipur, Meghalya, Mizoram, Nagaland, Orissa, Sikkim, Tripura, West Bengal and exports to Bhutan

Western Region: Comprises the states of Goa, Gujarat, Madhya Pradesh and Maharashtra.

2.2 Jetfuel demand projections

The demand for jetfuel is dependent upon the level of utilisation of air transport services in the country. The Indian domestic sector is primarily restricted to passenger services as there are little dedicated cargo operations. It is, hence, sufficient to estimate the passenger traffic only.

While the fuel for domestic air services is sourced indigenously, international carriers have the option to uplift jetfuel from destinations abroad as well. It is, thus, necessary to develop separate projections for international traffic.

In order to forecast the demand for passenger traffic, the project team reviewed forecasting techniques typically used to project air traffic. These are briefly described in Annexure 2.1. The International Civil Aviation Organisation (ICAO) manual on air traffic forecasts broadly suggests three types of methodologies for air traffic forecasts– trend projections, econometric modelling and market/industry surveys. In India, prior studies have generally been restricted to the domestic sector and have employed econometric modelling.

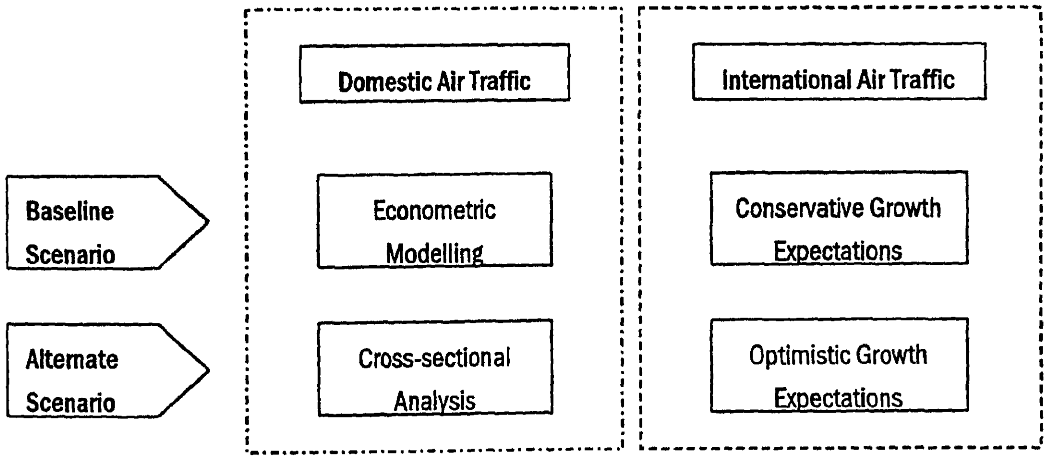
Our analysis utilises a combination of these above-mentioned methodologies. Projections for the domestic sector are based on econometric modelling utilising data on Indian macro-economic indicators and other relevant variables. The baseline domestic air traffic projections are subsequently estimated from the expected values of these variables during the projection period.

An alternate scenario that envisages a more favourable development of the domestic civil aviation sector has also been developed. The alternate scenario is based on a cross-sectional analysis of the state of the aviation industry in different countries at development levels comparable to the Indian economy.

Projections for the international sector have been developed on the basis of an industry survey as the macro-economic variables identified for the domestic analysis have little impact on international traffic. Estimates of the likely growth of the industry vary between the key airlines operating in India. While the baseline international traffic projections are based on conservative growth expectations of the key players, the alternate scenario is based on the optimistic expectations of the industry.

The overall procedure for air traffic forecasts is depicted in the matrix in Figure 2.2.

Figure 2.2 Air traffic projections: Methodology



2.3 Domestic air traffic

The Indian civil aviation sector is characterised by limited dedicated cargo operations. The projections, thus, have been restricted to those for domestic passenger traffic, assumed to be representative of the total domestic air traffic in the country.

2.3.1 Domestic passenger traffic

The project team interacted with industry experts, particularly those associated with planning for the national domestic carrier, Indian Airlines. These interactions revealed that business traffic (including that from the Government) accounts for about 70% of the total traffic, followed by foreign tourists in India accounting for another 20% and non-resident Indians visiting India accounting for about 7% of the total domestic traffic. Leisure/emergency travel accounts for a marginal 3% of the total traffic only.

The National Council of Applied Economic Research (NCAER) has been recently commissioned by the Confederation of Indian Industries (CII) to undertake a study on the civil aviation sector to identify infrastructure and regulatory bottlenecks; workout strategies to increase private sector participation and other funding mechanisms; and work out a draft civil aviation policy for the development of this sector. The project team also interacted with the NCAER team to discuss relevant issues.

The key variables likely to impact the demand for air travel include:

Gross Domestic Product (GDP) & it's sectoral components and the Index of Industrial Production (IIP)

Given the fact that the bulk of the air travel in India is accounted for by business travel, one of the key factors that is likely to influence demand for air travel would be performance of the corporate sector. While GDP is a good indicator to assess the level of economic activity in the country, its applicability in this situation is limited on account of the fact that it derives its value from other sectors like agriculture; communication; banking & insurance; public administration etc. which would have a limited impact on utilisation of air services.

Our analysis is, thus, based on specifically the industrial component of GDP and IIP, which are more representative of the performance of the corporate sector.

Foreign tourist arrivals (FTA)

Foreign tourists visiting India account for about 20% of the demand for domestic air travel. While all foreign tourists in India do not essentially use domestic air services, FTA is likely to have a very high correlation with the number of foreign tourists actually utilising domestic air services.

Foreign direct investments (FDI)

Current day corporate activity is significantly influenced by foreign investments in different sectors. High investments bolster the manufacturing base of the country and strengthen the economic fundamentals, thereby, improving the performance of the corporate sector.

Airline ticket prices

In developed aviation markets, decline in real fares have reportedly had a positive contribution to air traffic. ICAO studies show fare elasticities in the range of −0.7 to −1.5. These studies also concluded that fare elasticities with respect to leisure travel were much higher than those of business markets. While the Indian market is primarily business oriented, it was thought that ticket prices be included to check for fare elasticities if any existed.

In the absence of detailed information on airline ticket prices, average yields (defined as the ratio of total revenue to passenger kilometres performed) were considered as a good proxy variable for ticket prices. These were converted to constant 1980/81 prices.

2.3.2 Modelling traffic demand

The causal variables identified in the preceding section were used for regression analysis. Regression analysis involves abstracting a mathematical model from a real situation. In our analysis, domestic passenger traffic, in terms of revenue passenger kilometres (RPKMs), is posited as a function of the above mentioned variables, i.e.,

$$RPKMs = f(GDP, IIP, FTA, FDI, Yields)$$

The analysis involves estimating the functional form of the model from past data and using the functional form so derived, to predict the regressand (RPKMs) from projected values of the regressors (the chosen set of variables).

The functional form chosen for the regression analysis was the double log regression model:

$$Y = AX_1^bX_2^cX_3^d...$$

Where the regressand Y denotes the RPKMs performed and the regressors X_i denote the causal variables such as GDP, FTA, etc. The coefficients b, c, d ... indicate the elasticity of Y with respect to X, specifically, b indicates the elasticity of Y with respect to X_1 and so on. Elasticity of Y with respect to X is the percentage change in Y for a given change in X.

Thus, if X_1 is the GDP and Y the RPKMs performed, then b indicates the percentage change in RPKM given a percentage change in the GDP, namely the income elasticity of air travel.

2.3.3 *Analysis of regressors*

In regression analysis, given a superset of regressors (all causal variables), one identifies sub-sets of regressors which best fit the data, i.e., explain the variations in the regressand. Sometimes there is a high correlation between the regressors (causal variables), technically known as multicollinearity, due to which the coefficients (elasticities) cannot be estimated with precision or accuracy. In such a situation it is advised to drop one of the collinear variables. For example, there is a high correlation between IIP and industrial component of GDP. In such a situation, the model specification should include only one of these variables to avoid multicollinearity. Likewise, with FDI being a component of the GDP, there would be a high degree of correlation between the two and thus only one of the two variables ought to be considered. Since GDP is inclusive of FDI, FDI is dropped in favour of the GDP.

Subsequent analysis involves identification of statistically significant causal variables, i.e., identification of those regressors that explain the variations in the regressand and dropping those which do not explain the variations in the regressand.

A number of specifications were considered for estimating domestic air traffic demand. The first specification included the key regressors affecting travel demand. However, some of these regressors had to be dropped on account of counter intuitive results or statistically insignificant variables.

The various specifications tried are summarised in Table 2.5.

Table 2.5 Model specifications: Process of elimination

Specification	*Remarks*
RPKMs=f(GDP;I, FTA, Yields)	Dropped on account of counter-intuitive results with positive price elasticity and negative elasticity wrt FTA
RPKMs=f(GDP:I, Yield)	Dropped on account of counter intuitive results with positive price elasticity Yields not statistically significant
RPKMs=f(IIP, Yields)	Dropped on account of counter intuitive results with positive price elasticity
RPKMs=f(GDP:I)	Selected specification

The details of the model specifications that were dropped are presented in Annexure 2.2. The final specification is discussed in detail below.

Model specification: RPKMs=f(GDP:I)

With all the other combinations proving to be statistically insignificant or logically inconsistent, univariate regression analysis of RPKMs with Industrial GDP was finally adopted. The functional form of the model is presented below

$$RPKMs = A.\ GDP(I)^b$$

Or

$$Log(RPKMs) = Log(A) + b.Log[GDP(I)]$$

Where,
A= Constant
b= Elasticity of air travel demand with respect to industrial GDP

Table 2.6 presents the growth in the industrial component of GDP over the past few years:

Table 2.6 Industrial component of GDP (Rs. Million)

Year	Industrial components of GDP
1992/93	610910
1993/94	636580
1994/95	695734
1995/96	784298
1996/97	835383
1997/98	887411
CARG (1992-1997)	**7.8%**

Industrial GDP recorded an overall growth of 7.8% per annum during 1992/93-1997/98. Industrial growth had peaked in 1995/96 at 12.8% and has thereafter declined to 6.5% in 1996/97 and further to 6.2% in 1997/98. The slackening in the growth is attributed to many factors; erosion in competitiveness of Indian exports after the East Asian crisis, decline in rural demand owing to low agricultural output in 1997/98, price competition from imports in key industries and a slow take-off of actual investments in infrastructure projects.

The industrial downturn continued in 1998/99 with growth for April through October at only 3.5%. However, with the turnaround in the economy in the current fiscal year (1999/00), industrial output has revived with growth for April through October reported at 7.5%. Given the economic revival, but keeping in mind business cycles with lean and boom periods, an overall growth of 8% per annum is assumed for the projection period. This assumption is supported by the Ninth Five Year Plan projections of 8% growth in the industrial sector.

The regression statistics for the model specification are presented below.

Table 2.7 Regression statistics: final specification

Multiple R	0.91		
R Square	0.83		
Adjusted R Square	0.82		
Regressors	*Coefficients*	*Standard Error*	*t-Statistic*
Intercept	2.80	0.95	2.94
Log(Industrial GDP)	0.78	0.09	8.89

Interpretation of Statistics

Multiple R: Indicates the degree of association between the regressand and the regressors. It varies between 0, indicating no association and 1, indicating perfect positive correlation.

R-square: It is the square of Multiple-R and indicates the coefficient of determination of the model, i.e., the degree to which the variations in the regressand are explained by the regressors. It varies from 0 to 100%.

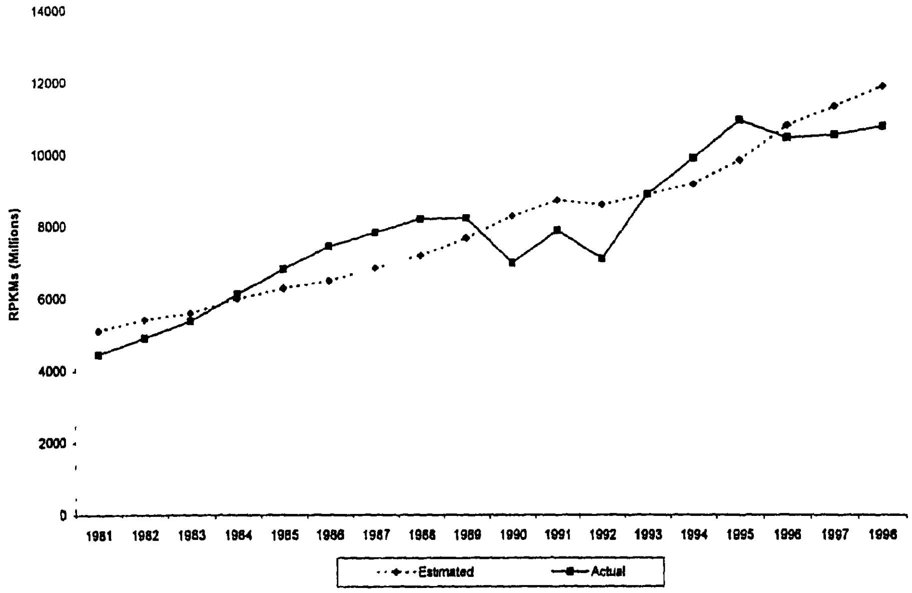
Adjusted R Square: R square, mentioned above, is a non-decreasing function of the number of regressors chosen for a model. Thus, if there are a large number of causal variables, the indicated R square would be high. Adjusted R square overcomes this problem by eliminating the effect of the number of regressors chosen for a specification.

Standard Error: It is an estimate of the precision of the estimator, i.e., measures the standard deviation of the sampling distribution of the estimator.

t-Statistic: Indicates if the given variable has any effect at all on the regressand, i.e., if it is statistically significant.

The model fit is reasonably good, as indicated by a high coefficient of determination (Adjusted R^2= 82%). The actual and estimated domestic air traffic is presented in Figure 2.3. The income elasticity of air travel demand is 0.78, i.e., if the Industrial GDP grows at an annual rate of 8% in the future (as assumed for the projection period), demand for domestic air travel is expected to increase at an annual rate of 6.2%.

Figure 2.3 Actual and estimated domestic air traffic: RPKMs (Millions)



2.3.4 *Inducing modal shifts*

The Indian Railways has introduced express trains under the umbrella category of "Rajdhani Express" linking key cities over long distances like Delhi-Mumbai, Delhi-Calcutta, Delhi-Chennai etc. These luxury trains offer air-conditioned sleeper berths to passengers and enjoy a growing popularity.

Trains under the umbrella category of "Shatabdi Express" have also been introduced. These are turnaround luxury trains plying at most a distance of about 1500 kms a day (total distance). Since the total travel time is less than 18 hrs (one way journey 9 hours), these trains do not have any sleeper berths.

An analysis was conducted to ascertain if any additional demand for air travel could be generated from inducing passengers using the top-of-line services offered by the Indian railways to switch to travel by air.

In 1998/99, 760,000 passengers availed the services of the First Class Air Conditioned coupes offered on key trains by the Indian Railways. These passengers accounted for 456 million passenger kilometres.

There are a number of factors that influence the choice of mode of travel by passengers. There are some passengers who prefer travelling by rail and would continue to do so irrespective of any incentives offered by airlines. Further, unlike air travel, rail passengers have a much wider choice of places to embark/disembark from. Finally, given the current tariff differential between the two modes, as indicated in Table 2.8, there is some disincentive in choosing air travel.

Table 2.8 Comparison of rail/air fares on key routes (Rs/Ticket)

Route	*Rail - First AC*	*Air*
Delhi-Mumbai	4180	5110
Delhi-Chennai	5965	7720
Delhi-Calcutta	4270	5930

Assuming that the airlines are able to offer an attractive package to induce even half of the passengers travelling by First AC to switch to air travel, at best the increase in air traffic (passenger kilometers) would be about 2% only.

Recently Jet Airways has introduced a short-haul flight from Delhi to Chandigarh in competition with the existing twice-a-day service of the Delhi-Chandigarh Shatabdi. Since large jets are uneconomical for short-hauls, Jet Airways has inducted the ATR 700 Turboprop aircraft on this route. The total flying time is one hour and the fare for economy class is Rs 2125. Compared to this, the rail journey takes 3 hours and 10 minutes with the Executive Class ticket costing Rs 865 only. The success of this new service is yet to be ascertained.

2.3.5 *Domestic air travel: alternate scenario*

In a developing country like India, utilisation of domestic air travel is far below that in the developed world. Air travel in India is dominated by business travel whereas in developed countries there is a substantial utilisation of air transport for personal/leisure activities. In general, air travel utilisation has been found to be higher in the developed countries. While the average utilisation in India was only 11 RPKMs per capita in 1996, utilisation in Mexico was 114 RPKMs per capita and that in the US was as high as 2524 RPKMs per capita.

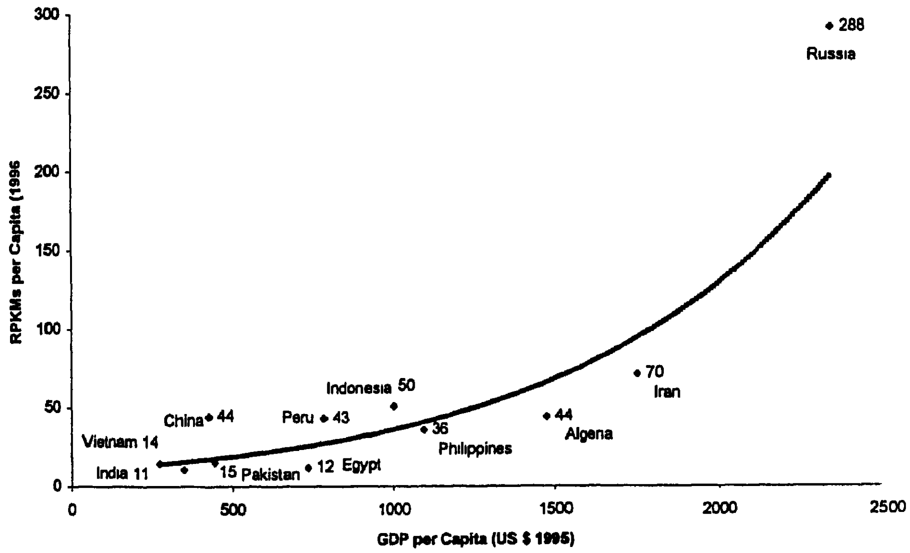
An analysis was thus carried out to examine air travel utilisation for different countries, to ascertain the relationship between the level of development and utilisation of air transport. Per capita incomes have been used as a proxy for the level of economic development. Table 2.9 lists the average utilisation rates and per capita incomes for a few countries.

Table 2.9 Per capita incomes and domestic air travel utilisation -cross country comparison

Country	GDP/Capita (1995 US $)	RPKMs/Capita (1996)
US	26026	2524
Australia	19522	1492
New Zealand	16026	818
Spain	14097	315
Portugal	10427	140
Korea	10142	180
Greece	8662	108
Argentina	8084	149
Chile	4736	162
Malaysia	4236	223
Mexico	2743	114
Russia	2333	288
Iran	1756	70
Algeria	1474	44
Philippines	1093	36
Indonesia	1003	50
Peru	784	43
Egypt	735	12
Pakistan	445	15
China	427	44
India	349	11
Vietnam	276	14

The analysis confirms that there is a high degree of correlation between income levels and utilisation of domestic air services. However, given the present status of utilisation of air travel in the country, it is not pragmatic to target utilisation rates in the developed world. An analysis was, thus, undertaken to relate air travel utilisation with income levels in the low and lower-middle income level countries (developing economies). In this selected sub-set, presented in Figure 2.4, Russia has the highest utilisation rate of 288 RPKMs per capita at a per capita income level of US $ 2333.

Figure 2.4 RPKMs per capita (Domestic) and per capita incomes



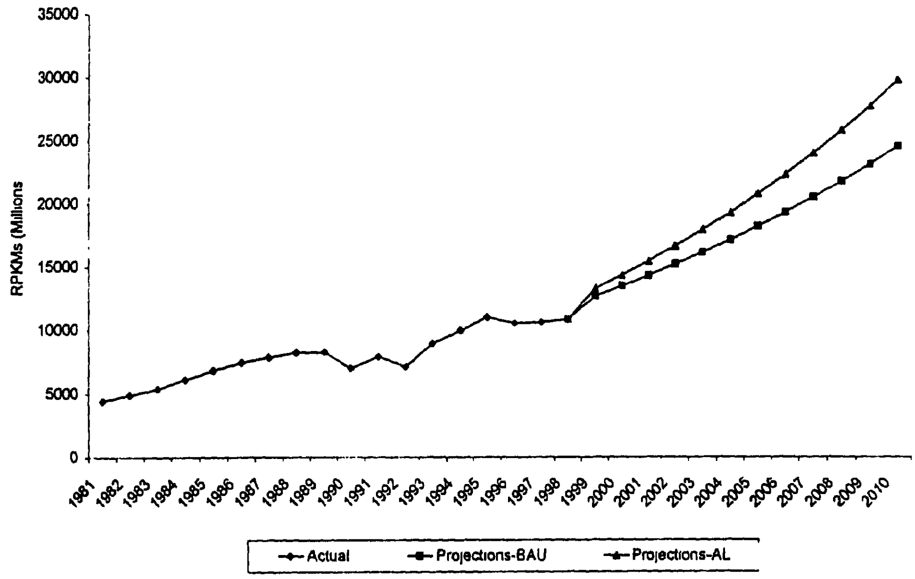
The Indian GDP grew at an average annual rate of 6.8% during the VIII plan period (1992/93-1996/97). The Ninth Plan envisages an overall growth of 6.5% per annum in the economy. Assuming a gradual deceleration in the rate of growth of the economy, an annual growth rate of 6.5% has been assumed for the period 1995-2010. In conjunction with the population projections estimated by the Expert Group constituted by the Ministry of Home Affairs, the per capita income in real terms is expected to rise at an annual rate of 5% till 2010. Indian per capita income is thus expected to be US $ 726 (at 1995 prices) in 2010 as compared to US $ 349 in 1995.

The cross-sectional data on air travel utilisation and per capita incomes indicates an exponential trend in utilisation of air transport as per capita incomes rise. The model fit is reasonably good with the coefficient of determination at 75%. Based on the functional form and the projected Indian per capita income of US $ 726 in 2010, the expected air transport utilisation is 26 RPKMs per capita in 2010. Projected air travel utilisation in India by 2010 is still less than the current utilisation in China at 44 RPKMs per capita. The large difference is explainable given the fact that the land area of China at 929 million hectares is almost thrice the area of India. Due to the relatively larger distances to be traversed, use of air transport services is likely to be higher in China as compared to India.

Air transport utilisation of 26 RPKMs per capita by 2010 represents an annual growth of 6% in utilisation from 1996 to 2010. The product of the projected utilisation factor and the population yields the expected demand for air travel in RPKMs.

The alternate scenario envisages development of aviation infrastructure in the country at par with that in other countries at a similar developmental stage. Thus, as the economy progresses, demand for air travel materialises in a fashion similar to what has been exhibited in these countries. Demand for air travel in the alternate scenario increases at an annual rate of 7.6% till 2010.

Figure 2.5 Projected demand for domestic air travel: BAU and alternate scenarios (RPKMs)



2.4 Domestic flights: jetfuel demand

In 1998/99, jetfuel sales to international airlines constituted about 55% of the total sales, while the rest accounted for sales to the domestic civil aviation sector and defence. While, detailed data on the proportion of sales to defence services is not available, experts opine that about 25% of the total jetfuel trade is accounted for by domestic civil aviation and the balance 20% is used by defence services. This structure of jetfuel sales has remained relatively the same over the recent years.

Table 2.10 Trends in jetfuel sales: international & domestic (TMT)

Year	*International*	*Domestic*	*Total*
1994/95	975	928	1903
1995/96	1066	1016	2082
1996/97	1156	1011	2167
1997/98	1131	987	2118
1998/99	1136	961	2097

2.4.1 *Modelling jetfuel demand*

Jetfuel demand for domestic airlines is likely to be influenced by two key drivers, the demand for domestic air travel and the price of jetfuel. The following specifications test the significance of these variables in estimating jetfuel demand.

First specification: jetfuel sales = f(RPKMs, Jetfuel Prices)

Again, the double log functional form was posited to estimate elasticities of domestic jetfuel demand with respect to domestic prices and RPKMs performed. The regression statistics are presented below.

Table 2.11 Regression statistics: jetfuel demand - first specification

Multiple R	0.98		
R Square	0.96		
Adjusted R Square	0.95		
Regressors	*Coefficients*	*Standard Error*	*t Statistic*
Intercept	-2.350	0.52	-4.50
Log(RPKMs)	0.741	0.04	17.99
Log(jetfuel Price)	0.003	0.04	0.09

The analysis revealed a positive price elasticity of jetfuel demand. Further, jetfuel price, when analysed in conjunction with RPKMs, proved to be statistically insignificant.

Final specification: jetfuel sales = f(RPKMs)

Thus, again, univariate regression analysis, with domestic jetfuel sales (proportionally derived as 25% of the total sales) as the regressand and RPKMs performed in the domestic sector as the regresssor, was adopted to forecast jetfuel demand. The functional form and regression statistics are presented below:

$$Jetfuel\ Demand = A.RPKMs^{b}$$

Or,

$$Log(jetfuel\ Demand) = Log(A) + b.\ Log(RPKMs)$$

Table 2.12 Regression statistics: jetfuel demand - final specification

Multiple R	0.98		
R Square	0.96		
Adjusted R Square	0.96		
Regressors	*Coefficients*	*Standard Error*	*t Statistic*
Intercept	-2.14	0.41	-5.22
Log(RPKMs)	0.74	0.04	20.36

The model fit is considerably good with a very high coefficient of determination (Adjusted R square = 96%). The elasticity of jetfuel demand with respect to RPKMs performed is 0.74. Jetfuel demand in the BAU scenario is expected to rise at an annual rate of 5.2% till the end of the projection period while that in the alternate scenario is envisaged at 6.5%. Past and projected domestic jetfuel demand under the two scenarios is presented in Table 2.13.

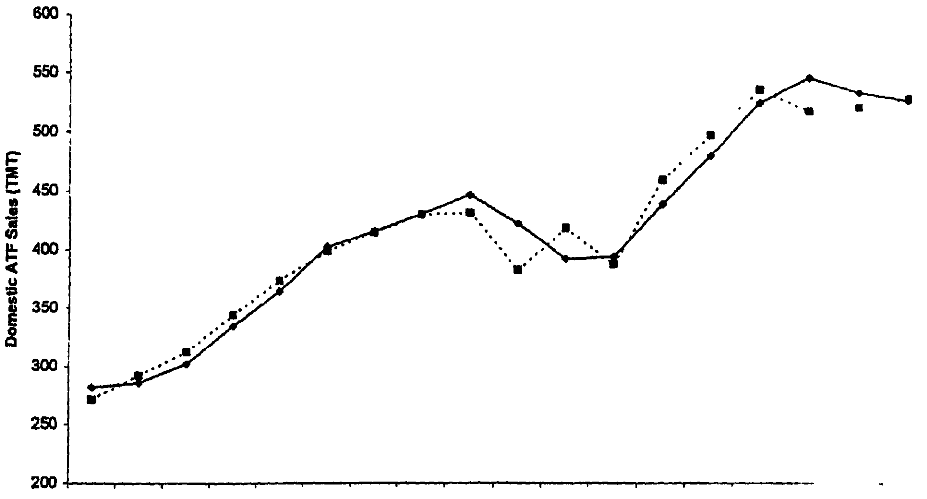
Table 2.13 Domestic jetfuel demand forecasts (TMT)

Year	*Domestic jetfuel Sales**	*Projections: BAU Scenario*	*Projections: Alternate Scenario*
1994/95	476		
1995/96	521		
1996/97	542		
1997/98	530		
1998/99	524		
1999/00		591	611
2000/01		618	647
2001/02		646	683
2002/03		675	722
2003/04		706	762
2004/05		738	805
2005/06		771	851
2006/07		806	897
2007/08		843	947
2008/09		881	999
2009/10		921	1054
2010/11		963	1112

* Assumed as 25% of the total jetfuel sales (Sales to the defence are not included)

Figure 2.6 indicates the degree of convergence between jetfuel demand as estimated from the model and the actual sales.

Figure 2.6 Actual and estimated domestic jetfuel sales



2.5 International air traffic

The total international passenger traffic, inbound and outbound, has increased at an annual rate of 7% over the period 1992-1998. Outbound traffic from India in general has exceeded the inbound traffic with an increasing number of Indians seeking employment abroad.

Table 2.14 Growth in international passenger traffic (Millions)

Year	*International Passenger Traffic*
1992/93	7.32
1993/94	7.73
1994/95	8.18
1995/96	9.41
1996/97	10.17
1997/98	10.66
1998/99	10.89

Bulk of the traffic is concentrated to and from the Middle East. The traffic in the India-Middle East segment primarily comprises of Indian blue collared work force seeking employment in the Gulf.

Traffic is also high between India and Europe, with the majority share of this traffic between India and UK. Of the total 2.3 million foreign tourists that visited India in 1996/97, foreign tourists from UK alone accounted for about 16% of the total volume.

While foreign tourists from Bangladesh accounted for 15% of the total foreign tourist arrivals, they only accounted for about 3% of the total air traffic. Likewise, while tourists from the United States accounted for 10% of the total arrivals, they too accounted for only 3% of the total air traffic.

Traffic in the India – East Asia segment is primarily business traffic. This traffic has been aptly dubbed "carriers" by the industry, as it comprises of small-scale businessmen/entrepreneurs who make use of the cost differential in goods between East Asian markets and India.

Altogether, a substantial portion of the inbound traffic comprises of non-resident Indians visiting relatives back home – the VFIR (visit for Indian relatives) traffic.

Passenger traffic to and from key destinations for 1996/97 is presented in Table 2.15.

Table 2.15 International passenger traffic on key routes: 1996/97 (Thousands)

Country	*To India*	*From India*	*Total*	*Percentage of Total Traffic*
Middle East				
UAE	721	707	1428	14%
Saudi Arabia	464	528	991	10%
Dubai	449	465	915	9%
Kuwait	241	256	496	5%
Europe				
United Kingdom	376	391	766	8%
Germany	266	287	553	5%
Netherlands	101	104	205	2%
East Asia				
Singapore	354	380	734	7%
Thailand	198	209	407	4%
South Asia				
Nepal	263	252	515	5%
Sri Lanka	253	241	494	5%
Bangladesh	130	127	256	3%
Pakistan	97	106	203	2%
North America				
United States	141	151	291	3%
Sub-Total	**3912**	**4052**	**7964**	**79%**
Others	1050	1102	2152	21%
Total	**4962**	**5154**	**10116**	**100%**

2.5.1 Distribution of international traffic

There has been a deceleration in the growth in international traffic. The growth in traffic has declined from 8% in 1996/97 to 5% in 1997/98 and 2% in 1998/99. Dissagregated information on traffic handled at international airports (April to December 1998), reveals that of the five international airports then, only Delhi airport posted an increase in international traffic while all other indicated a decline in traffic handled over the previous years.

While the bulk of the traffic is handled at the international airports, there was a robust growth in traffic handled at customs airports (with limited facilities to cater to international traffic).

Table 2.16 International traffic at Indian airports (Thousands)

Airport	*1998*	*1997*	*Change*
	(April - December)		
International Airports*			
Mumbai	3619	3717	-2.6%
Delhi	2754	2687	2.5%
Chennai	1318	1322	-0.3%
Calcutta	453	460	-1.5%
Thiruvanthapuram	635	646	-1.6%
Sub-Total	8780	8832	-0.6%
Customs Airports			
Bangalore	100	98	2.5%
Hyderabad	135	94	44.0%
Ahmedabad	101	98	3.7%
Goa	91	92	-1.4%
Calicut	211	222	-4.9%
Varanasi	45	50	-9.5%
Trichy	51	50	3.1%
Amritsar	14	4	310.4%
Coimbatore	9	1	1603.4%
Patna	6	2	205.6%
Sub-Total	765	709	7.8%
Total	9544	9541	0.0%

* Excludes Cochin airport which started handling international airports in May 1999

The highest growth in traffic at customs airport was observed at Coimbatore in the state of Tamil Nadu (Southern India), followed by Amritsar in the state of Punjab (Northern India) and Hyderabad in the state of Andhra Pradesh (Southern India).

A substantial portion of the traffic to the Gulf originates from Southern India, which is availing the facilities of the Coimbatore customs airport. Bulk of the India-UK traffic originates from the state of Punjab and hence there has been a high growth rate in traffic handled at Amritsar. Hyderabad and Bangalore are the software hubs of the country and with an increasing number of software professionals going abroad, the growth in utilisation of the Hyderabad customs airport is quite high.

.5.2 *International air traffic projections*

International air traffic is influenced by a variety of exogenous variables including inter-governmental relations. A substantial portion of the outbound traffic comprises of Indians seeking employment abroad. The immigration policies of target destinations like USA, UK and the countries in the Gulf, thus, influences the level of outbound traffic. For instance, the US government sets limits on visa quotas that can be issued from different countries all over the globe to control immigration. A downward revision in this quota is likely to reduce outbound traffic to the US to a large extent. Likewise, a recent decision by the countries in the Gulf to curtail immigrations from India has reportedly eroded the volumes on this segment.

It is difficult to abstract a representative mathematical formula that captures these externalities. Thus, an industry survey was conducted and views were sought on the likely growth of traffic in this segment.

Estimates of growth in international traffic in the next few years vary from those as high as 20% per annum (Air France) to more moderate levels of 8-10% (Lufthansa).

Given the fact that international traffic has been growing at an annual rate of 7% in the past, we have assumed an annual growth of 8% in the baseline scenario and a growth of 12% (pessimistic Air France estimates) in the alternate scenario for the projection period.

2.6 International flights: jetfuel demand

Despite the relatively higher prices in India, airlines, which operate on a turnaround basis necessarily refuel in India. For instance, all Lufthansa flights are return flights to Frankfurt from Delhi and Mumbai. The Lufthansa fleet of Boeing 747-400s each have a tank capacity of about 160 tons of jetfuel. The average fuel consumption from India to Frankfurt varies from 80 to 100 tons depending on the flying conditions, circling time before landing, etc. Even though there is surplus tank capacity, the logistics involved in balancing the weight load factor and carrying additional fuel, warrant refueling for the return flight from India.

Most of the international airlines operating from India do so on a turn around basis. These include Air France, British Airways, Lufthansa, KLM, SAS, Swiss Air, etc. Given such a scenario, fuel upliftment from India is likely to be independent of posted prices in India. Thus, the demand for jetfuel by international airlines is posited as a function of the quantum of international passengers.

Model specification: jetfuel sales = f (international passengers)

Univariate regression analysis, with jetfuel sales (international airlines only) as the regressand and international passengers as the regresssor, was adopted to forecast jetfuel demand. The functional form and regression statistics are presented below:

$$\text{Jetfuel Demand} = A.Pss[I]^b$$

Or,

$$\text{Log(jetfuel Demand)} = \text{Log}(A) + b.\ \text{Log}(Pss[I])$$

Table 2.17 Regression statistics: jetfuel demand - final specification

Multiple R	0.95		
R Square	0.90		
Adjusted R Square	0.86		
Regressors	*Coefficients*	*Standard Error*	*t Statistic*
Intercept	-2.17	1.79	-1.21
Log[Pss(I)]	0.57	0.11	5.12

The model fit is reasonably good with a high coefficient of determination (Adjusted R square = 86%). The elasticity of jetfuel demand with respect to RPKMs performed is 0.57. The low elasticity figure may be indicative of the fact that all airlines do not uplift fuel in India and that there is not a linear convergence between the increase in international traffic and the growth in jetfuel demand.

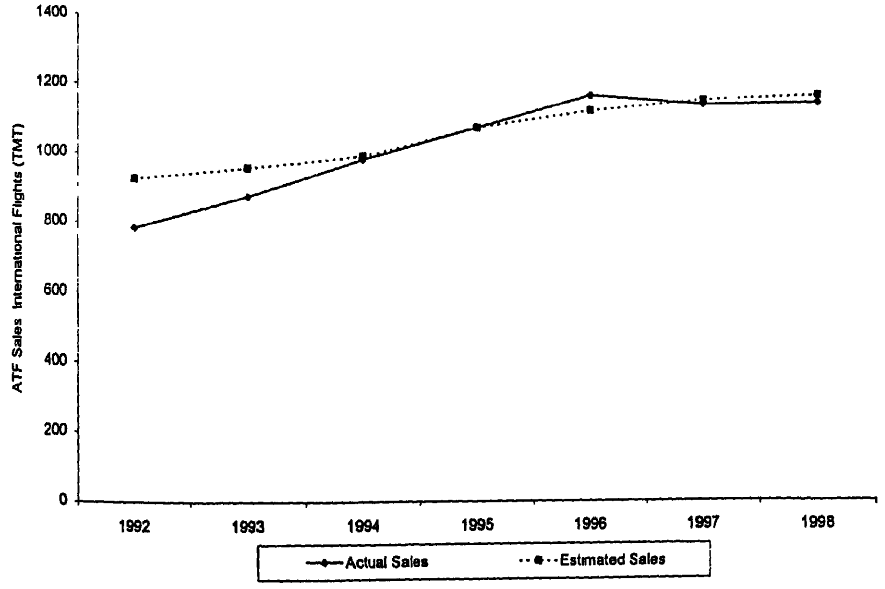
Jetfuel demand in the BAU scenario is expected to rise at an annual rate of 4.5% till the end of the projection period while that in the alternate scenario is envisaged at 6.8%. Past and projected domestic jetfuel demand under the two scenarios is presented in Table 2.18.

Table 2.18 Jetfuel demand forecasts: international flights (TMT)

Year	*International jetfuel Sales*	*Projections: Baseline Scenario*	*Projections: Alternate Scenario*
1994/95	975		
1995/96	1066		
1996/97	1156		
1997/98	1131		
1998/99	1136		
1999/00		1210	1235
2000/01		1264	1317
2001/02		1321	1405
2002/03		1380	1499
2003/04		1442	1599
2004/05		1506	1705
2005/06		1574	1819
2006/07		1644	1940
2007/08		1718	2069
2008/09		1795	2207
2009/10		1875	2355
2010/11		1959	2511

Figure 2.7 indicates the degree of convergence between actual jetfuel sales to international flights and those estimated from the model. On account of lack of information on total international traffic prior to 1992/93 (data available for Indian carriers only), the comparison between the two is presented for a limited time period only.

Figure 2.7 Jetfuel sales to international flights: actual and estimated (TMT)



2.7 Aggregate jetfuel demand projections

While, we are not presenting any estimates of the likely requirements of jetfuel by the defence forces, the aggregate jetfuel demand is presented assuming that the current share of defence at 20% of the total jetfuel sales continues to hold for the future as well.

Table 2.19 Aggregate jetfuel demand projections (TMT)

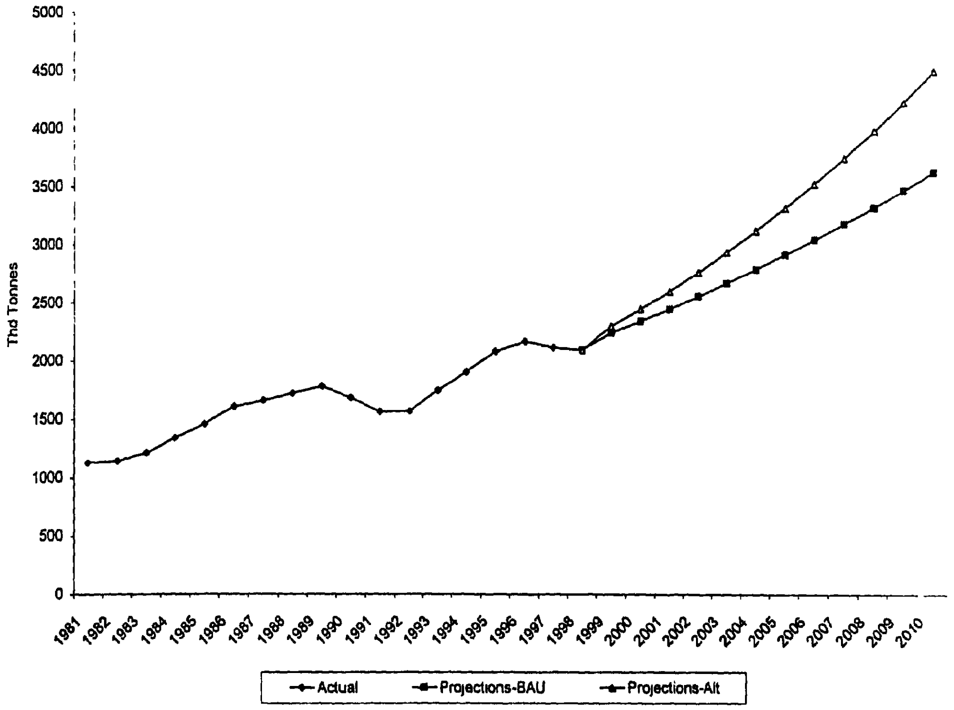
Year	*Baseline Scenario*	*Alternate Scenario*
1999/00	2251	2308
2000/01	2352	2456
2001/02	2458	2611
2002/03	2568	2776
2003/04	2684	2952
2004/05	2805	3138
2005/06	2931	3337
2006/07	3063	3547
2007/08	3201	3770
2008/09	3345	4008
2009/10	3495	4261
2010/11	3653	4529

Growth rates in jetfuel demand under the two scenarios are presented in Table 2.20.

Table 2.20 Jetfuel demand: growth rates - BAU and alternate scenarios

Sector	*Baseline Scenario*	*Alternate Scenario*
Domestic	5.2%	6.5%
International	4.6%	6.8%
Defence	4.3%	6.2%
Total	4.7%	6.6%

Figure 2.8 Aggregate jetfuel demand projections (TMT)



Regional jetfuel demand projections under the two scenarios for select years are presented in Table 2.21. On account of the long gestation periods in commissioning new greenfield airports, it is expected that demand in the projection period is also likely to be concentrated at current demand centres only. Regional demand in the projection period has thus been prorated in accordance with the current regional sales.

Table 2.21 Regional aggregate jetfuel demand projections (TMT)

Region	*Baseline Scenario*			*Alternate Scenario*		
	2000/01	*2005/06*	*2010/11*	*2000/01*	*2005/06*	*2010/11*
North	935	1165	1451	976	1326	1800
South	428	534	665	447	608	825
East	224	279	348	234	318	432
West	765	953	1188	799	1085	1473
Total	2352	2931	3653	2456	3337	4529

Jetfuel demand the twelve airports, identified in the terms of reference for the study, is presented in Table 2.22. Again, it is assumed that these airports would continue to command a proportional share during the forecast period as well.

Table 2.22 Projected aggregate jetfuel demand at select airports (TMT)

Airport	*1998/99*	*Baseline Scenario*			*Alternate Scenario*		
		2000/01	*2005/06*	*2010/11*	*2000/01*	*2005/06*	*2010/11*
Delhi	554	621	774	964	648	881	1195
Mumbai	519	582	725	903	607	825	1120
Calcutta	51	57	71	89	60	81	110
Chennai	112	125	156	194	131	177	241
Thiruvanthapuram	40	45	56	70	47	64	87
Cochin*	11	12	15	19	13	17	23
Bangalore	63	70	87	109	73	100	135
Hyderabad	36	40	50	63	42	57	78
Guwahati	15	17	21	26	18	24	33
Ahmedabad	18	20	25	31	21	29	39
Bhubaneshwar	5	6	7	9	6	8	11
Lucknow	1	2	2	3	2	2	3
Sub-Total	**1424**	**1597**	**1990**	**2480**	**1667**	**2266**	**3075**
Others	673	755	941	1173	788	1071	1454
Total	**2097**	**2352**	**2931**	**3653**	**2456**	**3337**	**4529**

* International operations at Cochin airport were started recently only and, thus, with a likely redistribution of international traffic in the South, the proportionate shares of jetfuel demand at airports in the South may change

Annexure 2.1

Review of methodologies for air traffic projections

ICAO manual on air traffic forecasting

The International Civil Aviation Organisation (ICAO) manual provides a summary of techniques used for medium and long-term air traffic forecasts. This manual is used by personnel of civil aviation administrations, airline planners and planners of airports.

The manual identifies three main methods of forecasting civil aviation traffic, namely, trend projection, econometric forecasting and industry/market surveys. These methods vary in the amount of data and statistical analysis required and in the degree to which subjective judgement plays a role.

Trend projections

Trend analysis assumes that the past is representative of the future, and, thus extrapolates past trends into the future. Extrapolations can be done graphically or be specifying trend curves. The commonly used specifications include linear trends, exponential trends, parabolic trends and the gompetrz curve (wherein a curve reaches saturation levels over long time periods).

Applications of trend analysis in air traffic forecasts involve observing past trends in air traffic in terms of revenue passenger kilometers (RPKMs) performed or passengers carried. These trends are subsequently extrapolated based on any of the above mentioned specifications which best suit the observed trend.

Econometric forecasting

While trend analysis is undoubtedly the simplest of all forecasting techniques, it is often criticised, as it does not take into consideration the effects of various economic, social and operational conditions. Econometric forecasting involves determining, on the basis of historical data, a quantitative relationship between traffic on one hand and important variables which influence air traffic on the other hand, and then using this relationship and forecasts of underlying variables to derive the traffic forecast.

Econometric forecasting, thus, involves selection of relevant causal factors; specification of the functional relationship between the dependent and independent variables; and forecasting the future development of independent variables.

Causal variables identified by ICAO for econometric analysis include size and spending power of potential clientele, ethnic ties between regions, price and quality of air transport service, access to air transport facilities and the price and quality of competing transport services wherever applicable.

The choice of functional forms ranges from simple linear models to more complex double log or log -linear models. The advantage of log models lies in their abilities to identify demand elasticities, which quantifies the relationship between the dependent variable and the causal variable.

Market/industry surveys

Surveys aim at analysing the characteristics of markets for air transport in order to examine empirically how the use of air transport varies across different sectors of the population and industry. Such surveys are typically used in those situations wherein the use of air transport is restricted to a limited few well-defined sectors. The accuracy of such surveys is related to the extent of sampling and extensive surveys are time consuming.

Global market forecast: 1999-2018 by airbus industries

The forecast by Airbus Industries predicts that over the next 20 years civil air transport will remain one of the world's great growth industries. During 1999 to2018, the global market forecast predicts:

Passenger traffic (Revenue Passenger Kilometers) will grow at an average annual growth rate of 5%, while cargo traffic (Freight Tons Kilometers) growth will average 6% per year.

The number of seats in passenger service will increase from 1.8 to nearly 4.2 million, while the capacity of dedicated freighter fleet will grow from 64,000 to almost 1,80,000 Tons.

The active passenger fleet will grow from some 10,000-passenger jets at the end 1998 to 19,106 at end 2018. Dedicated air cargo services will grow more rapidly than passenger aircraft service.

Demand for air travel will continue to be driven primarily by economic growth/GDP, which will become more sensitive to changes in real fare levels. To develop growth projections, a number of variables have been analysed and an econometric modelling has been used. Overall, according to the estimates by Airbus, passenger traffic measured in Revenue Passenger Kilometers (RPK) during the next ten years to 2008 will grow at an average annual rate of 5.12%

and during the following decade, the average annual growth will continue at 4.85%.

Air traffic forecasts: Indian context

The following section provides a brief of prior studies undertaken to forecast the demand for air traffic in India. Except for the forecasts by Mr D P Singh at the end of this section, all studies have restricted their focus to the domestic civil aviation sector.

Macro economic outlook for the air transport industry: upto year 2005, by Dr Tridib K Biswas, Managing Director, TN Associates, Toronto, Canada

The study discusses various factors affecting the aviation growth in India. These factors are GDP, industrial growth, number of tourists, travel cost in real terms and other global, regional and local factors. The econometric model used for forecasting is given below:

$$\mathrm{Log}\,(RPK) = -15.26 + 1.804\,\mathrm{Log}\,(GDP) + 0.373\,\mathrm{Log}(FTA)$$

Where,

RPK= Revenue Paying Kilometers
GDP= Gross Domestic Product
FTA= Foreign Tourist Arrival

The coefficients of the independent variables, GDP and FTA, indicate the estimates of demand elasticities with respect to these variables i.e., they indicate the sensitivity of demand for air travel to GDP and FTA. An average growth rate of 7% of GDP is taken and using the demand elasticity estimate, the estimate of market for air transport sector in India is determined. The analysis shows that the market for air transport sector for India should grow at a rate of about 13-15% per annum. Also, with growing exports and imports of India, the air transport will have an obvious impact.

Growth prospects of the air transport sector by Rashid Jung, Former Planning Manager, Indian Airlines

This paper analyses the factors, which are expected to affect the prospects of growth in air travel in the future.

A traffic demand forecast model has been developed for Indian domestic market. The author has found that capacity and yield (average revenue per passenger kilometre performed) played an important role in determination of demand. These parameters are represented by a combined factor SFFI, an aggregate index of capacity and yield. The model used in this exercise is:

$$\text{Log}(RPK) = C + 1.3\,\text{Log}(GDP) + 0.3\,\text{Log}(FTA) - 0.7\,\text{Log}(SFFI)$$

Where,

GDP= Gross Domestic Product at current prices

FTA= Foreign Tourist Arrivals

SFFI= Increase (positive) or decrease (negative) in seat factors and the fare index from the base value.

The forecast given is based on a long-term scenario of:

- Real GDP growth rate of 6% p.a.
- Inflation constant at 8% p a
- FTA growth rate of 7% p a
- Seat factors constant at current level throughout
- Real yield growth of 10% p a

Domestic air transport in 2005 by M S Balakrishnan, DGM, Corporate Planning, Indian Airlines.

Indian Airlines has been using methods of statistical analysis to understand and quantify the effect of economic variables on air traffic demand. Their model establishes strong correlation between the national income and air traffic demand. While FTA is also a strong driving force in the analysis, the outcome of the model analysis shows that a 5% growth in national income leads to a 9% growth in traffic demand. Similarly a 10% growth in FTA is estimated to contribute to about 4% growth in domestic passenger carriage. Based on the Planning Commission's forecast of GDP and the Department of Tourism's forecast of number of FTA, the paper has estimated a long-term annual traffic growth of 12.5% in domestic civil aviation industry.

Domestic perspective on the civil aviation

Tata Economic Consultancy Services (TECS) and Mr V A Valiaparampil developed forecast models for domestic passenger traffic. While the former was commissioned by the Planning Commission in 1986, the latter was commissioned by the Ministry of Civil Aviation in September 1993. Both these studies made use of the following econometric models respectively.

TECS model:

$$Log\ (RPK) = -5.53275+1.87144Log(GDP)+0.334791Log(FTA)$$

Valiaparampil Committee model:

$$Log\ (RPK) = -15.26+1.806Log(GDP)+0.373Log(FTA)$$

Where,

RPK = Revenue Passenger Kilometers
GDP = Gross Domestic Product at 1970/71 prices
FTA = Foreign Tourist Arrivals in India for each year.

These two models are quite close to each other in respect of demand elasticities with respect to GDP and FTA.

Air traffic demand forecast by D P Singh, Senior Economic Planning Manager, AAI

This paper provides estimates of growth rates in air traffic demand based on the methodology that is used by the Department of Corporate Planning and Management Services of Airport Authority of India (AAI). The aviation demand is forecasted in terms of aircraft movements- passengers and cargo. The period under analysis is from 1996/97 to 2011/12. Econometric /regression models are used to develop forecasts choosing different combination of variables like GDP/GNP, population, IIP, disposable income, oil prices, investment in tourism etc.

In 1995/96, the four major airports of Bombay, Delhi, Calcutta and Chennai handled about 66% of the total domestic passenger traffic and 95% of the international passenger traffic. These airports also handled about 83% of the total domestic cargo and 98% of the international cargo traffic. Identical set of database is maintained at all the domestic and international airports for the sake of convenience and uniformity in the analysis. The views of the experts engaged in the field of Civil Aviation, government policies, bilateral agreements, airlines fleet expansion, inter country relationship and retiring plans are also taken into consideration.

The forecast of the international traffic is linked up with domestic traffic. Historically, it has been established that there is a close relationship between the international and domestic traffic demand. The forecasts are made on an aggregate basis and are split for individual airports adopting the ratio analysis techniques. A comparison is also made with similar forecasts prepared by airlines, IATA, ICAO, aircraft manufacturer, and other related organizations.

Review of methodologies for projecting jetfuel demand

Taking off: The US demand for air travel and jet fuel by Dermot Gately, The Energy Journal, Vol 9, No.4

The author assumes the equation of jet fuel demand as a log linear function of seat miles, the price of fuel and lagged fleet efficiency, which is defined as seat-miles/gallon.

$$log\ (fuel\ demand)_t = a + blog\ (seat\text{-}miles)_t + clog\ (fuel\ price)_t + dlog\ (seat\text{-}miles/gallon)_{t-1}.$$

Where, seat mile per person is assumed to be a log linear function of real GNP per person, real ticket prices and a dummy variable for the effects of 1981-air controllers' strike in US.

It is also assumed to be a function of lagged passenger miles per person, in order to account for lagged adjustment to price and income changes. So in the equation form it is given as:

$$Log\ (PM/person) = a\ Log\ (GNP/person)_t + b\ Log\ (ticket\ price)_t + c\ Dummy1981 + d\ Log\ (PM/person)_{t-1}$$

Here, the coefficients imply long run elasticities for ticket price and GNP/person. The fuel efficiency of the US airline fleet is the result of many factors: the utilisation of each airline's mix of planes, the retrofitting of existing planes, the purchase of new planes and the retirement of old planes. These factors depend on several factors like fuel prices, seat –miles, the cost of retrofitting and the cost of new and used planes of various types. It is assumed that fleet efficiency, measured in seat-miles per gallon (SMG), is determined by a time trend made by the real price of jet fuel.

In equation form, it is given as:

$$SMG_t = a + b\ (fuel\ price)_t + c\ (time) + d\ (SMG)_{t-1}$$

The sample period is from 1966 to 1986. The analysis is carried out in five intervals of time period, which is 1965-69, 1969-76, 1976-79, 1979-82, and 1982-86.

Forecast and analysis of demand for petroleum products in India Raghavendra D Rao and Jyoti K Parikh: Energy Policy, Vol.24 No.6 pp583-592, 1996

In this paper, the authors have analysed demand for all the major petroleum products including jetfuel. An econometric model based on time series data is used to project the jetfuel demand till 2010. The factors considered to study the jetfuel consumption are share of travel, communication and trade in GDP (Y), index of industrial production (IIP), price of jetfuel (P) and technical change (t). The model is given as:

$$\textit{Jetfuel demand} = 1.26\, Y^{0.75P\wedge((-0.08 \ln(t)-0.03 \ln(IIP)\, t\wedge(0.13 \ln(IIP)))}$$

Three scenarios have been generated considering different assumptions regarding Y. It is assumed that grow at a rate of 5%, 5.5% and 6% respectively in the three scenarios. In all the scenarios, the price index of jetfuel is assumed to grow at its observed long-term trend of 9% per annum and IIP is assumed to grow at an annual rate of 8% during the forecast period.

The projected demand increases by 2.7 to 3 times across the overall forecast period. The demand is expected to grow from 1.90 million tonnes in 1995/96 to 5.05 million tonnes in 2010/11 at an annual rate of 6.7%.

A summary of the methodologies discussed above is presented in the following.

Summary of various estimates of air traffic and jetfuel demand

Author	*Final year of forecast*	*Model***	*Estimate*
Traffic Forecasts			
Tridib K Biswas	2005	Log(RPK)= -15.26+1.804LogGDP+0.373FTA	10-15% per annum till 2005
Rashid Jung	2005	Log(RPK)= c+1.3 Log(GDP)+ 0.3 Log(FTA)-0.7 Log(SFFI)	10.5% in 1995/96, 9% during 1996/97 to 1997/98 and 7.5% during 1998/99 to 2005/06
M S Balakrishanan	2005	Log(RPK)= a+ bLog(GDP)+ cLog(FTA)	Annual growth rate of 12.55% with tapering growth to 10% beyond 1998 to 2005
D P Singh	2011/12	Demand = f(GNP/GDP, IIP, Population, Disposable Income, Oil prices and Investment in tourism)	During 1996 to 2011, the traffic will grow at the following rates International: 5.5% to7% Domestic: 7% to 10.5% International cargo: 9% to 12% Domestic cargo: 4% to 6%
Jetfuel Forecasts			
Raghavendra D Rao and Jyoti K Parikh	2010	*$1.26\, Y^{0.75P\wedge((-0.08 \ln(t)-0.03 \ln(IIP)\, t\wedge(0.13 \ln(IIP)))}$	1.9 million tonnes to 5.05 million tonnes* from 1995/96 to 2010/11

*Jetfuel demand

** Abbreviations are defined above in the summary of papers

Annexure 2.2

Model specifications: domestic air travel

First specification: RPKMs = f(GDP:I, FTA, Yields)

The model posits demand for air travel as a function of the industrial component of GDP, which is the driver for business travel; foreign tourist arrivals, to cater to use of air transport facilities by foreign tourists in India; and yields to test for price elasticity of demand.

The regression statistics are presented below:

Regression statistics: first specification

Multiple R	0.91
R Square	0.83
Adjusted R Square	0.77

Regressors	*Coefficients*	*Standard Error*	*t-Statistic*
Intercept	-0.22	5.84	-0.04
Log[GDP:I]	2.52	0.72	3.51
Log[FTA]	-1.04	0.57	-1.83
Log[Yield]	0.82	0.38	2.12

These statistics indicate a reasonably good fit, but the results are counter intuitive. The elasticity of travel demand with respect to FTA is negative indicating that for a given increase in FTA, the demand for air travel would come down. In addition, the variable FTA, in the above mentioned specification, is not statistically significant.

The results also indicate a positive price elasticity of demand indicating that for a given reduction in air fares, the demand for air travel is likely to come down which again is counter intuitive.

On the basis of the above analysis, FTA as a regressor was dropped from the specification.

Second specification: RPKMs=f(GDP:I, Yields)

The above model posits air travel demand as a function of industrial component of GDP and air fares only as FTA proved to be statistically insignificant. The regression results are presented below.

Regression statistics: Second specification

Multiple R	0.88		
R Square	0.77		
Adjusted R Square	0.72		
Regressors	*Coefficients*	*Standard Error*	*t-Statistic*
Intercept	-5.39	5.69	-0.95
Log[GDP:I]	1.60	0.57	2.80
Log[Yield]	0.61	0.41	1.48

Again the results indicate a positive price elasticity of demand, which is counter intuitive. In addition, yields are not statistically significant.

Third specification: RPKMs=f(IIP, Yields)

While there is a high correlation between GDP:I and IIP, there are slight variations between the two. It was, thus, decided to check if the combination of IIP and yield proved to be logically consistent and significant. The regression statistics are presented below.

Regression statistics: third specification

Multiple R	0.90		
R Square	0.81		
Adjusted R Square	0.77		
Regressors	*Coefficients*	*Standard Error*	*t-Statistic*
Intercept	4.95	1.63	3.04
Log[IIP]	1.34	0.39	3.45
Log[Yield]	0.55	0.32	1.72

Again, price elasticity of air travel proved to be positive and statistically insignificant.

3 Supply-demand balances

3.1 Jetfuel Supply

3.1.1 *Introduction*

In 1998/99, the 15 Indian refineries had a combined throughput of 68.56 million tonnes of crude. Of these only the Mangalore refinery is under the joint sector, while the rest are public sector units. In 1999/00, two more refineries were inaugurated, the Numaligarh refinery in Assam and the Reliance refinery in Gujarat. While, the 27 MMTPA Reliance refinery's current monthly crude throughput averages around 700-800 TMT, Numaligarh refinery is due to start commercial production shortly. With other projects like Essar's refinery at Vadinar yet to be commissioned, the private sector will command a substantial portion of the refining sector. Table 3.1 lists the crude throughputs of different refineries during 1998/99.

Table 3.1 Refinery throughputs in 1998/99 (Million Tonnes)

Refinery location	*Throughput*
Northern region	
IOC, Mathura	8.88
IOC, Panipat	2.22
Sub-Total	**11.10**
Southern region	
MRL, Manali	6.10
CRL, Cochin	7.78
HPCL, Vishakh	3.88
MRL, Narimanam	0.65
MRPL, Mangalore	4.07
Sub-Total	**22.48**
Eastern region	
IOC, Barauni	2.22*
IOC, Haldia	4.71
IOC, Guwahati	0.84
IOC, Digboi	0.56
BRPL, Bongaigaon	1.67*
Sub-Total	**10.00**
Western region	
BPCL, Mumbai	8.84
HPCL, Mumbai	5.25
IOC, Koyali	10.90
Sub-Total	**24.99**
Total	**68.56**

* Barauni and Bongaigaon refineries operated below their rated capacities in 1998/99 due to limited availability of North-East crude

Estimates of expected availability of jetfuel in the country are based on addition of new refining capacity and expansion of existing ones. Expansions/additions to refining capacity beyond 2006/07 (Terminal year of the Tenth Five Year Plan) are not known. The refining capacity for the period upto 2010/11 has thus been assumed to be the same as that at the end of the Tenth Plan.

3.1.2 *Expansion of existing refineries*

Since expansion of existing refinery units offers a low cost option as opposed to putting up grass roots refineries, the expansion proposals will find easier acceptance and their materialisation will be quicker. The likely existing refinery throughputs till the end of the Tenth plan are summarised in the Table 3.2.

Table 3.2 Estimated refining throughputs(MMTPA)

Refinery	*1998/99*	*1999/00*	*2000/01*	*2001/02*	*2002/03*	*2003/04*	*2004/05*	*2005/06*	*2006/07*
Northern Region									
IOC, Mathura	8.88	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
IOC, Panipat	2.22	4.30	6.00	6.00	9.00	9.00	9.00	9.00	9.00
Sub-Total	**11.10**	**13.30**	**15.00**	**15.00**	**18.00**	**18.00**	**18.00**	**18.00**	**18.00**
Southern Region									
HPCL, Vishakh	3.90	6.00	7.50	7.50	7.50	7.50	7.50	7.50	7.50
MRL, Manali	6.10	6.50	6.50	6.50	6.50	9.50	9.50	9.50	9.50
MRL, Nanmanam	0.60	0.70	0.70	0.70	1.00	1.00	1.00	1.00	1.00
CRL	7.80	7.80	7.80	10.50	10.50	10.50	10.50	13.70	13.70
MRPL	4.10	5.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Sub-Total	**22.50**	**26.00**	**31.50**	**34.20**	**34.50**	**37.50**	**37.50**	**40.70**	**40.70**
Eastern Region									
IOC, Barauni	2.20	3.30	4.20	6.00	6.00	6.00	6.00	6.00	6.00
IOC, Haldia	4.70	4.70	4.70	5.00	5.00	5.00	5.00	5.00	5.00
IOC, Guwahati	0.84	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IOC, Digboi	0.56	0.60	0.65	0.65	0.65	0.65	0.65	0.65	0.65
BRPL, Bongaigaon	1.70	2.00	2.54	2.54	2.54	2.54	2.54	2.54	2.54
IBP/BPCL, Numaligarh	0.00	1.60	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Sub-Total	**10.00**	**13.10**	**16.09**	**18.19**	**18.19**	**18.19**	**18.19**	**18.19**	**18.19**
Western Region									
BPCL, Mumbai	8.84	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
HPCL, Mumbai	5.25	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90
IOC, Koyali	10.90	10.90	12.50	13.70	18.00	18.00	18.00	18.00	18.00
RPL, Jamnagar	0.00	9.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Sub-Total	**25.00**	**34.80**	**54.40**	**55.60**	**59.90**	**59.90**	**59.90**	**59.90**	**59.90**
Total	**68.56**	**87.20**	**116.99**	**122.99**	**130.59**	**133.59**	**133.59**	**136.79**	**136.79**

3.1.3 New refineries

In order to increase the refining capacity, policy changes were first introduced by the Indian government in 1985 by promoting formation of joint venture (JV) companies for setting up new refineries. Under these arrangements, the public sector company and the joint venture partner each held 26% of the equity with the balance being offered to financial institutions and the general public.

The refining sector was subsequently thrown open to the private sector on further liberalisation of the Indian economy from 1991. Since then, letters of intent have been issued by the Government to a number of joint venture and private sector companies for putting up new refineries. Subsequent delicensing of the refinery sector took place in 1997.

On the basis of the latest available information and a review of the progress made on the new projects, an indication of the earliest possible year of commissioning of each new refinery has been ascertained. It may be noted that the actual refinery throughput in a given year may be less than the rated capacity. For instance, the 27 MMTPA Reliance refinery initiated trial runs in July 1999. While the current monthly crude throughput is around 800 TMT, the total expected throughput for the year 1999/00 is about 9 million tonnes. Likewise, while the rated capacity of the Essar refinery is 12 MMTPA, its total throughput in the year 2002/03 is expected to be only about 6 million tonnes. Expected annual throughputs of new refineries are summarised in Table 3.3.

Table 3.3 Expected throughputs of new refineries (MMTPA)

Refinery	*2002/03*	*2003/04*	*2004/05*	*2005/06*	*2006/07*
Northern Region					
HPCL, Bhatinda				4.00	9.00
Sub-Total				4.00	9.00
Southern Region					
NFCL, Cuddalore	6.00	6.00	6.00	6.00	6.00
Sub-Total	6.00	6.00	6.00	6.00	6.00
Eastern Region					
IOC, Paradip			5.00	9.00	9.00
Sub-Total			5.00	9.00	9.00
Western Region					
Essar, Vadinar	6.00	12.00	12.00	12.00	12.00
BPCL, Bina			3.00	6.00	9.00
Sub-Total	6.00	12.00	15.00	18.00	21.00
Total	12.00	18.00	26.00	37.00	45.00

3.1.4 *Product availability*

Resulting from commissioning of new refineries and refinery expansions, the cumulative throughput of domestic refineries is likely to increase to the following levels:

- 128.94 MMTPA by the year 2001/02
- 184.79 MMTPA by the year 2006/07
- 184.79 MMTPA by the year 2010/11

Table 3.4 summarises the expected refinery throughputs.

Table 3.4 Expected refinery throughputs (MMTPA)

Region	*Company*	*Location*	*State*	*2001/02*	*2006/07*	*2010/11*
Northern						
	HPCL	Bhatinda	Punjab	0.00	9.00	9.00
	IOC	Panipat	Haryana	6.00	12.00	12.00
	IOC	Mathura	Uttar Pradesh	9.00	9.00	9.00
		Northern Region		**15.00**	**30.00**	30.00
Southern						
	MRL	Manali	Tamil Nadu	6.50	9.50	9.50
	MRL	Narimanam	Tamil Nadu	0.65	1.00	1.00
	NOCL	Cuddalore	Tamil Nadu	0.00	6.00	6.00
	CRL	Cochin	Kerala	10.50	13.70	13.70
	HPCL	Vishakh	Andhra Pradesh	7.50	7.50	7.50
	MRPL	Mangalore	Karnataka	9.00	9.00	9.00
		Southern Region		**34.15**	**46.70**	46.70
Eastern						
	IOC	Guwahati	Assam	1.00	1.00	1.00
	IOC	Digboi	Assam	0.65	0.65	0.65
	BR & PL	Bongaigaon	Assam	2.54	2.54	2.54
	IBP/BPCL	Numaligarh	Assam	3.00	3.00	3.00
	IOC	Barauni	Bihar	6.00	6.00	6.00
	IOC	Haldia	W Bengal	5.00	5.00	5.00
	IOC	Paradip	Orissa	0.00	9.00	9.00
		Eastern Region		**18.19**	**27.19**	27.19
Western						
	BPCL	Mumbai	Maharashtra	9.00	9.00	9.00
	HPCL	Mumbai	Maharashtra	5.90	5.90	5.90
	Reliance	Jamnagar	Gujarat	27.00	27.00	27.00
	IOC	Koyali	Gujarat	13.70	18.00	18.00
	Essar	Vadinar	Gujarat	6.00	12.00	12.00
	BPCL	Bina	Madhya Pradesh	0.00	9.00	9.00
		Western region		61.60	80.90	80.90
		Total		128.94	184.79	184.7

Jetfuel availability in the country has been projected on the basis of the indicated jetfuel yields from each refinery. Yield patterns used for this analysis are the latest estimates of the industry. Jetfuel and Kerosene yield of each refinery is summarised in Table 3.5.

Table 3.5 Jetfuel and Kerosene yields

Region	*Company*	*Location*	*Jetfuel Yield*	*Kerosene Yield*
Northern Region				
	HPCL	Bhatinda	1.34%	8.61%
	IOC	Panipat	6.40%	1.63%
	IOC	Mathura	8.04%	5.66%
Southern Region				
	MRL	Manali	6.33%	6.73%
	MRL	Narimanam	0.00%	17.8%
	NOCL	Cuddalore	8.50%	10.53%
	CRL	Cochin	1.08%	5.41%
	HPCL	Vishakh	0.96%	7.78%
	MRPL	Mangalore	2.00%	11.57%
Eastern Region				
	IOC	Guwahati	0.00%	7.00%
	IOC	Digboi	0.00%	8.50%
	BR & PL	Bongaigaon	3.00%	8.30%
	IBP/BPCL	Numaligarh	2.91%	37.15%
	IOC	Barauni	0.00%	8.03%
	IOC	Haldia	4.47%	0.71%
	IOC/KPC	Paradip*	9.24%	9.24%
Western Region				
	BPCL	Mumbai	2.88%	5.15%
	HPCL	Mumbai	7.40%	2.60%
	Reliance	Jamnagar	0.14%	1.45%
	IOC	Koyali	4.21%	8.93%
	Essar	Vadinar	4.76%	1.90%
	BPCL	Bina	1.13%	19.00%

* Refers to DPK

Based on the projected refinery throughputs and the yield pattern, jetfuel availability in the country for select years is presented in Table 3.6. Results are presented for the current year, and years 2000/01, 2005/06 and 2010/11, in the projection period, for which the supply-demand balances have been developed.

Table 3.6 Jetfuel availability from refineries (TMT)

Region	Company	Location	State	1999/00	2000/01	2005/06	2010/11
Northern Region							
	HPCL	Bhatinda	Punjab	0	0	54	121
	IOC	Panipat	Haryana	275	384	767	767
	IOC	Mathura	Uttar Pradesh	723	723	723	723
		Northern Region		**998**	**1107**	**1544**	**1611**
Southern Region							
	MRL	Manali	Tamil Nadu	412	412	602	602
	NOCL	Cuddalore	Tamil Nadu	0	0	510	510
	CRL	Cochin	Kerala	84	84	148	148
	HPCL	Vishakh	Andhra Pradesh	58	72	72	72
	MRPL	Mangalore	Andhra Pradesh	100	180	180	180
		Southern Region		**654**	**748**	**1512**	**1512**
Eastern Region							
	BR & PL	Bongaigaon	Assam	60	76	76	76
	IBP/BPCL	Numaligarh	Assam	47	87	87	87
	IOC	Haldia	W Bengal	211	211	224	224
	IOC/KPC	Paradip	Orissa	0	0	750	750
		Eastern Region		**317**	**374**	**1137**	**1137**
Western Region							
	BPCL	Mumbai	Maharashtra	259	259	259	259
	HPCL	Mumbai	Maharashtra	437	437	437	437
	Reliance	Jamnagar	Gujarat	7	33	38	38
	IOC	Koyali	Gujarat	458	526	757	757
	Essar	Vadinar	Gujarat	0	0	571	571
	BPCL	Bina	Madhya Pradesh	0	0	68	102
		Western region		**1161**	**1255**	**2129**	**2163**
		Total		**3130**	**3484**	**6322**	**6423**

3.2 Jetfuel Demand

Demand projections for jetfuel have been presented in Chapter 2. Projections were developed under two scenarios, the baseline scenario and the alternate scenario, which assumes a more favourable development of the industry. The projections under the two scenarios for the projection period are summarised in Table 3.7.

Table 3.7 Jetfuel demand projections (TMT)

Year	*Baseline Scenario*	*Alternate Scenario*
1999/00	2251	2308
2000/01	2352	2456
2001/02	2458	2611
2002/03	2568	2776
2003/04	2684	2952
2004/05	2805	3138
2005/06	2931	3337
2006/07	3063	3547
2007/08	3201	3770
2008/09	3345	4008
2009/10	3495	4261
2010/11	3653	4529

Regional demand for jetfuel for select years is presented in Table 3.8.

Table 3.8 Regional jetfuel demand projections (TMT)

Region	*Baseline Scenario*			*Alternate Scenario*		
	2000/01	*2005/06*	*2010/11*	*2000/01*	*2005/06*	*2010/11*
North	935	1165	1451	976	1326	1800
South	428	534	665	447	608	825
East	224	279	348	234	318	432
West	765	953	1188	799	1085	1473
Total	2352	2931	3653	2456	3337	4529

3.3 Supply-demand balances

Jetfuel supply and demand projections are summarised in Table 3.9. It may be noted that the supply projections are based on the indicated yield patterns of individual refineries and do not take into account the impact of the overall demand-supply scenario of jetfuel on the production plans of each refinery. Per se, these projections reveal a clear surplus in the country to the tune of 75% in the baseline scenario and about 40% in the alternate scenario by the year 2010/11, thereby eliminating the need for any imports of jetfuel.

Table 3.9 Supply demand balance (TMT)

Year	Supply	Demand		Surplus	
		Baseline Scenario	Alternate Scenario	Baseline Scenario	Alternate Scenario
1999/00	3030	2251	2308	779	722
2000/01	3304	2352	2456	952	848
2001/02	3686	2458	2611	1229	1075
2002/03	4855	2568	2776	2286	2079
2003/04	5237	2684	2952	2552	2285
2004/05	5270	2805	3138	2466	2132
2005/06	5392	2931	3337	2461	2055
2006/07	5493	3063	3547	2430	1946
2007/08	5493	3201	3770	2293	1723
2008/09	5493	3345	4008	2148	1485
2009/10	5493	3495	4261	1998	1233
2010/11	5493	3653	4529	1841	964

The surplus peaks in the year 2003/04 and declines thereafter as demand firms up and the additions to refining capacity slow down. However, it must be borne in mind that there are no additions to refining capacity beyond 2006/07, as no firm proposals for the same are available yet. In case there are subsequent additions beyond 2006/07, the surplus will magnify.

Regional supply demand balance is presented in Table 3.10.

Table 3.10 Regional supply -demand balance (TMT)

Region	Baseline Scenario			Alternate Scenario		
	2000/01	2005/06	2010/11	2000/01	2005/06	2010/11
Supply						
North	1107	1544	1611	1107	1544	1611
South	748	1512	1512	748	1512	1512
East	374	1137	1137	374	1137	1137
West	1255	2129	2163	1255	2129	2163
Total	3484	6322	6423	3484	6322	6423
Demand						
North	935	1165	1451	976	1326	1800
South	428	534	665	447	608	825
East	224	279	348	234	318	432
West	765	953	1188	799	1085	1473
Total	2352	2931	3653	2456	3337	4529
Surplus						
North	173	380	160	131	218	-188
South	320	978	846	301	904	687
East	150	858	789	140	819	706
West	490	1176	975	456	1044	690
Total	1132	3391	2771	1028	2985	1894

The analysis reveals a surplus situation in all the regions in the baseline scenario with the highest surplus in the Western region followed by the Southern region. The Western region currently commands bulk of the refining capacity and will continue to do so in the forecast period. Thus, despite the region's high demand for jetfuel, there is a surplus in the region.

A low demand in the Southern region coupled with additional jetfuel availability of jetfuel from the Cuddalore refinery yields a high surplus.

In the alternate scenario, the Northern region shows a deficit by the year 2010/11. The deficit in the North is likely to be met from the surplus in the West. Product transfer is likely to be through the Kandla-Bhatinda product pipeline and by rail ex-Koyali.

3.3.1 Supply-demand balances: Partial build up of new jetfuel manufacturing capacity

Despite the inter-regional transfers to correct demand-supply imbalances, a surplus of 1.9 million tonnes by 2010/11 remains.

Currently, kerosene is earmarked as a fuel for rural areas and about 1.2 million tonnes of kerosene were imported in 1997/98. With the expected transition of rural households from traditional to commercial fuels, it will be imperative to increase the availability of kerosene.

Given the expected overall jetfuel surplus situation, it is likely that new refineries would refrain from developing jetfuel manufacturing capacity and instead maximise kerosene production. Table 3.11 analyses the supply demand scenario where none of the new units produce jetfuel.

Table 3.11 Jetfuel supply-demand balance with supply from existing refineries only(TMT)

Region	*Baseline Scenario*			*Alternate Scenario*		
	2000/01	*2005/06*	*2010/11*	*2000/01*	*2005/06*	*2010/11*
Supply						
North	1107	1491	1491	1107	1491	1491
South	748	1002	1002	748	1002	1002
East	374	387	387	374	387	387
West	1255	1490	1490	1255	1490	1490
Total	3484	4370	4370	3484	4370	4370
Demand						
North	935	1165	1451	976	1326	1800
South	428	534	665	447	608	825
East	224	279	348	234	318	432
West	765	953	1188	799	1085	1473
Total	2352	2931	3653	2456	3337	4529

Region	*Baseline Scenario*			*Alternate Scenario*		
	2000/01	*2005/06*	*2010/11*	*2000/01*	*2005/06*	*2010/11*
Supply						
Surplus/Deficit						
North	173	326	39	131	165	-309
South	320	468	336	301	394	177
East	150	108	39	140	69	-44
West	490	537	302	456	405	17
Total	**1132**	**1439**	**717**	**1028**	**1033**	**-160**

Alternate demand scenario

The alternate demand scenario indicates regional deficits in the North and the East by 2010/11, including an overall deficit in the country. The deficit in the North, would hence, justify jetfuel production at the proposed HPCL Bhatinda refinery to the extent of its entire output of 121 TMT. This would still leave an additional requirement of about 188 TMT.

Of the two new refineries in the West at Vadinar (Essar) and Bina (BPCL), the former is expected to be commissioned earlier. Given the substantial jetfuel yield of the Essar refinery of 571 TMT, it is expected that the Essar refinery would meet the balance requirements of the Northern region. Since, the additional requirement totals only 188 TMT, the excess production capacity would either remain unutilised or be used to produce dual purpose Kerosene. Given the surplus situation in the combined Northern & Western region, it is expected that the Bina refinery would review their proposed additional investment to manufacture jetfuel or decide to retain the facility to meet only the demand in the vicinity, for instance, that at Allahabad, Kanpur , Lucknow, etc.

The deficit in the East would be met through production of dual purpose kerosene (DPK) at the new refinery at Paradip. While the yield pattern indicates a capability to produce 750 TMT of DPK, which can easily cover the deficit of 44 TMT in the region, it is for consideration whether such a large DPK manufacturing capacity should be established in view of the low offtake from the closest air field station, i.e., Bhubaneshwar.

The surplus in the south would be eliminated by curtailing jetfuel production at the Mangalore refinery. While the refinery has a capacity to produce 180 TMT of jetfuel, currently jetfuel is not produced on account of a low demand in the region except for in September 1999 when 1000 mt of jetfuel was refined for local consumption. jetfuel may, thus, be produced on a need based basis.

The likely jetfuel production from each refinery in 2010/11, in light of the above mentioned, is summarised in Table 3.12.

Table 3.12 Jetfuel manufacturing capability and indicative output from each refinery: 2010/11 (TMT)

Region/ Refinery Location	*Manufacturing Capability*	*Output: Baseline Scenario*	*Output: Alternate Scenario*
Northern Region			
Bhatinda	121	0	121
Panipat	767	728	767
Mathura	723	723	723
Sub-Total	**1611**	**1451**	**1611**
Southern Region			
Manali	602	589	602
Cochin	148	57	148
Vishakh	72	19	72
Sub-Total	**822**	**665**	**822**
Eastern Region			
Bongaigaon	76	76	76
Numaligarh	87	48	87
Haldia	224	224	224
Paradip	750	0	48
Sub-Total	**1137**	**348**	**435**
Western Region			
Mumbai (BPCL)	259	259	259
Mumbai (HPCL)	437	437	437
Jamnagar	38	0	38
Koyali	757	493	757
Vadinar	571	0	172
Sub-Total	**2061**	**1188**	**1662**
Total	5632	3653	4529

Baseline demand scenario

Even if none of the new refineries produce jetfuel, there is an overall surplus in the baseline demand scenario resulting from expansions of existing refineries alone.

Thus, on account of a lower demand, the baseline demand scenario calls for a drastic reduction in jetfuel production vis-à-vis the manufacturing capability as indicated in Table 3.12. jetfuel production will be curtailed at Panipat in the North; Manali, Cochin, and Vishakh in the South; Numaligarh, and Paradip in the East; and at Jamnagar, Koyali and Vadinar in the West.

Table 3.12 highlights excess domestic availability of jetfuel over demand, obviating the need for any imports into the country. The excess manufacturing capabilities would either not be built or be built at a lower capacity and any excess capacity would remain under-utilised or used to make dual purpose kerosene.

4

Petroleum products infrastructure and Jetfuel supply logistics

4.1 Existing distribution arrangements for petroleum products

4.1.1 Distribution setup

Till recently, marketing of petroleum products was being handled by four oil companies exclusively in the public sector (PSUs). Three of these companies, viz. IOC, HPCL and BPCL are integrated refining and marketing companies, whereas IBP purchases MS, HSD, Kero and a few other products from the refiners for resale. The pioneer national oil company, viz. IOC own seven of India's seventeen refineries and also market most of the products of CRL and BRPL. They have entered into an MOU with the first private sector refinery of RPL at Jamnagar, commissioned in July 1999, to market 50% production of most products in Jamnagar refinery. Virtually all imports of crude and refined products for the PSUs are canalised through IOC and their 1998-99 share of market sales was 54%. HPCL with two refineries, besides having at its disposal products from its joint sector refinery at Mangalore and an arrangement to draw products from Jamnagar refinery in the required quantities, held a share of market sales of 19%. BPCL with one refinery and marketing rights for product sales ex MRL as well as well as arrangement to draw products from Jamnagar refinery like HPCL, had a share of market sales of 21%. IBP's share of sales amounted to 5%.

Besides direct despatches from the refineries distribution of major petroleum products by the four PSUs is undertaken from a total network exceeding 46 Marketing Port Terminals (at 22 locations), 37 installations at pipeline tap-off points/terminals (at 23 locations), 260 inland depots and installations (at 152 locations) and terminals at seven inland refinery locations, having an aggregate tankage of nearly 10 million Kl. There are more than 100 LPG bottling plants from where LPG cylinders are filled and distributed. Aircraft fuelling is handled from over 65 Aviation Fuel Stations catering to civil traffic.

Some private marketers, including a few multinationals, are now marketing LPG under the parallel marketing scheme. Under a similar dispensation, parallel marketing of Kerosene is also being done by some private sellers, including RPL.

Also, sale of products decontrolled from 1st April, 1998, viz. Naphtha, FO, LSHS, Bitumen and Paraffin Wax is now open to the private sector.

4.1.2 *Modes of transport*

Petroleum products from the refineries are transported to inland installations, depots and large consumers by rail tank wagons in full train loads. Products are also carried to consuming areas by dedicated pipelines with tap-off points enroute. Substantial enlargement of the pipeline network is envisaged in the years ahead. In some cases, supply of petrochemical feedstocks, naphtha to petrochemical complexes and FO/LSHS to power plants put up in the vicinity of refineries is made by pipelines. Along the coast, tankers are effectively used to move products to port terminals or between refineries.

From refineries/port terminals/inland depots/pipeline tap-off points, products are carried through road tank-trucks to oil companies' motor spirit/HSD retail outlets. The tanktrucks are similarly used for carrying various products to the captive storages of large direct customers. Kerosene and LDO are also transported through tank trucks by oil company distributors for making deliveries into barrels at the premises of retailers, both in rural and urban areas; who supply needs of millions of consumers, including delivery of kerosene through public distribution system.

LPG is carried in bulk through LPG rail tankwagons in trainloads and by tank-trucks to road fed bottling plants. Some large industrial consumers of LPG receive bulk supplies through tank-trucks.

The manner in which the respective modes of transport operate is described below:

Tankers

Movement of products from coastal refineries is a regular feature to cope with product imbalances and to position products at a pivotal port terminal like Kandla on the west coast from where large scale movement is undertaken into the deficit North-West region through the long distance Kandla-Bhatinda products pipeline and by rail.

The coastal movement is undertaken by the three integrated oil companies, viz. IOC, HPCL and BPCL by employing the available fleet of Indian tankers. The tankers are engaged on time or voyage charters at freight rates negotiated between the shipping and oil companies periodically. The deployment of vessels is closely coordinated between PSUs depending upon their overall requirements.

The oil industry moved over 5 million tonnes of products through coastal tankers in the year 1997-98.

Rail tankwagons

Petroleum industry has been heavily dependent upon rail movement for transporting petroleum products within the country. Railways were steadily adding to their fleet of rail tankwagons upto the year 1991-92 when the percentage of transport of petroleum products by rail attained its peak at 46%.

Railways stopped inducting any new tankwagons for petroleum products after the year 1991/92 and their fleet remains stagnant at approximately 28,000 broad gauge (BG) 4-wheeler, 6,000 BG 8-wheeler and 2,900 metre gauge (MG) tankwagons. There is no replacement for aged wagons being decommissioned. Furthermore, a massive ongoing rail track gauge conversion programme from metre to broad gauge over 10,000 km of track length is under implementation which will render most of 2,900 MG tankwagons redundant.

The above policy has resulted in Railways not being able to fully move the petroleum products traffic offered to them. Over the past few years, the oil industry has had to resort to very sizeable road bridging in order to maintain supplies to their upcountry storage points. Such road bridging attained a very high level equivalent to 1410 white oil and 76 black oil tank wagons per day in the year 1995/96. In terms of volume, this amounted to moving over 11 MMT of products by road from supply sources to storage points. Though total quantity moved has increased, the progressive decline in the overall share of petroleum products transporation by rail can be seen from the following Table 4.1.

Table 4.1 Average tankwagon loading (No. of tank wagons per day)

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
BG white oil	2220	2301	2430	2431	2675	2791	2804	3204
BG black oil	355	406	394	394	429	432	338	365
Fuel oil (low sulphur)	347	292	276	294	236	271	310	309
LPG	51	65	72	74	82	99	129	146
MG white oil	303	345	295	262	281	256	202	118
MG black oil	18	17	20	18	12	9	11	4
Total products traffic by rail (MMT)	25.1	26.2	26.5	26.1	28.6	29.3	29.1	30.7
Percentage of total petroleum products consumption	45.6	46.0	44.9	43.9	43.7	40.4	37.7	38.3

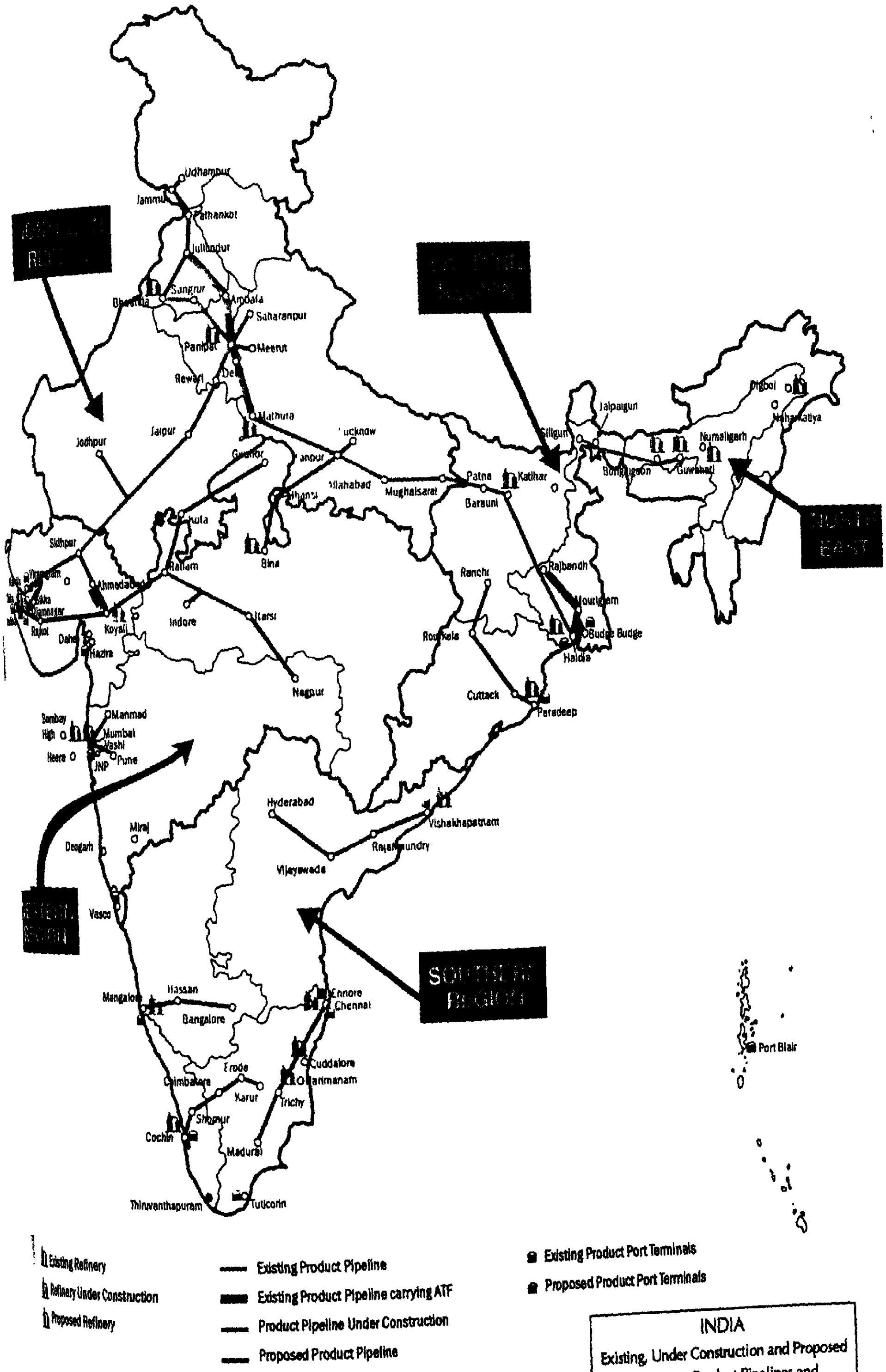
Discontinuation of capital investment in new wagons by the railways is across the board and this has affected a broad spectrum of the industry. Railways now expect large industrial consumers to pay for their wagon requirements under `Own your Wagon' scheme floated after 1991/92. They claim that public and private sector companies have so far acquired about 5,000 wagons under this scheme for transporting various products and orders for another 5,000 wagons are reportedly imminent. PSUs have also placed orders for procurement of some 8-wheeler BG tankwagons of their own, including LPG tankwagons. Some improvements have recently been agreed to by the Railways in `Own your Wagon' scheme with an offer to make payment of lease charges to the industrial enterprise concerned in advance.

Product pipelines

The advantages of transportation of petroleum products by pipeline vs rail are well known. The pipeline mode is generally more economic, has much lesser handling and operation losses, helps pollution control, is safe and offers exclusive control and flexibility to the oil industry. The National Transport Policy Committee had therefore concluded in 1980 that the pipeline mode should be encouraged.

The expansion of product pipeline network in India has been slow due to stiff opposition by the Government owned Indian Railways on the plea that very large investments made on tracks, rolling stock and other railway infrastructure, after taking into account oil industry's requirements as one of the biggest users of rail transportation, will go waste. However, the commissioning of the Kandla-Bhatinda pipeline and recent completion of two more strategic pipelines from Mumbai to Manmad in the western region and Vishakhapatnam to Vijayawada in the southern region, will give further impetus to this development.

Figure 4.1 shows existing, under construction and proposed product pipelines. The pipelines presently in operation, their capacities and throughputs are given in the following Table 4.2.



INDIA

Existing, Under Construction and Proposed Refineries, Product Pipelines and Product Port Terminals

Date : January 2000

Figure : 4.1

Table 4.2 Existing pipeline network

Pipeline	Capacity (MMTPA)	Length (km)	1997-98 throughput *(MMT)
Guwahati-Siligun	0.82	435	1.08
Haldia-Maungram-Rajbandh	1.25	269	1.88
Haldia-Barauni	1.42	525	1.50
Barauni-Mughalsarai-Allahabad Panki (Kanpur)	1.80	669	1.76
Koyali-Sabarmati (Ahmedabad)	1.10	116	1.57
Mumbai-Pune	3.85	161	3.99
Mathura-Bijwasan (Delhi)-Ambala-Jalandhar	3.70	513	3.29
Kandla-Sidhpur-Salawas (Jodhpur)-Sanganer (Jaipur)-Rewari-Sangrur-Bhatinda	6.00	1331	5.19
Mumbai-Manmad	4.33	252	Commissioned in March 1998
Vishakh-Rajahmundry-Vijayawada	4.10	356	Commissioned In May 1998

* It will be noticed that most of the pipelines were operating at more than rated or near full capacity in 1997-98.

There are other pipelines proposals which are under implementation and those for which feasibility reports have either been approved or are being prepared. These include expansion of Kandla-Bhatinda pipeline to 11.5 MMTPA capacity and extension of Vishakh-Vijayawada pipeline to Hyderabad. According to one estimate, the cost of expanding the existing pipelines and implementing all new proposals, including the Mumbai-Manmad and Vishakhapatnam-Vijayawada pipelines commissioned recently, is of the order of Rs 50,000 million.

Besides having to generate this large capital investment, an arrangement is required to be put in place by the oil industry which enables each marketing and refining company to have equitable use of the available pipeline capacity. This will include all joint venture and private sector companies operating refineries or participating in marketing of petroleum products, particularly after the administered pricing mechanism is dispensed with.

For this purpose, the Government of India had approved the formation of a holding company (with participation of interested companies from both public and private sectors) and subsidiary joint venture companies for the implementation of petroleum product pipeline projects. The move was aimed at encouraging private investment in pipeline projects and appears to be a preparatory measure for ultimate decontrol of the oil industry. The four PSUs viz. IOC, BPCL, HPCL and IBP have formed such a holding company called 'Petronet' with an initial authorised capital of Rs 1000 million of which they hold 50% equity. Besides them, Indian Leasing and Financial Services Ltd. hold 10% equity and other financial institutions and insurance companies may also be invited to become equity partners. Petronet has already taken work in hand on the following new product pipelines by forming a separate subsidiary joint venture company for each of these pipelines:

Vadinar-Sikka-Kandla (nearing completion)
Cochin-Coimbatore-Karur (under construction)
Mangalore-Hassan-Bangalore (construction to start shortly)
Chennai-Trichy-Madurai
Central India Pipeline from Vadinar/Jamnagar to Koyali-Ratlam-Itarsi-Nagpur with branch lines enroute
Bina-Jhansi-Kanpur

Whereas the Central India pipeline has just been approved, feasibility reports for the other two pipelines are under consideration or preparation.

Some other deserving new pipeline proposals are also being examined by Petronet. Besides some short distance and link pipelines, these include the long distance Paradeep-Cuttack-Rourkela-Ranchi pipeline as well as extension/expansion of a few existing pipelines.

Tanktrucks

These are primarily used for secondary movement to MS/HSD retail outlets of oil companies, large direct customers of products having captive storages and for supply of kerosene and LDO through distributors of oil companies to the vast number of retailers of these products all over the country. A total fleet of over 15,000 tanktrucks, owned by transporters and under contract with oil companies, is being deployed.

Oil companies also strategically maintain a smaller number of their own tank trucks, representing less than 10% of the contract fleet, confined to a few metro cities as a small safeguard to keep up essential supplies in the event of transport contractors collectively disrupting movement in protest against some unsettled issues. The oil company tanktrucks meet part of the requirements of their respective MS/HSD outlets in metro cities.

A major portion of LPG for bottling plants spread all over the country is transported by road through a separate fleet of tank-trucks deployed by PSUs on contract basis. A few large bottling plants receive supplies of LPG by rail tankwagons in full rakeloads.

4.1.3 *Sales plan entitlement (SPE)*

Sales of multinationals before their take-over were confined to the authorised refining capacity of each company. The entire remaining trade fell in the lap of the then only national oil company IOC, who were exclusively patronised for all the government business. As a result, IOC were holding nearly 65% share of total sales when multinationals were converted into HPCL and BPCL and Assam Oil company was merged into IOC.

In order to promote competition between the public sector marketing companies, the government introduced SPE scheme whereby only 50% of estimated growth in demand was allocated to IOC and the other three marketing companies shared the remaining half of the growth on a specified basis so that they could increase their market participation. Within their overall allocation, the companies used to mutually decide the product mix for each company, including companywise allocation of large consumer business for products like FO/LSHS and Naphtha, on an annual basis which was approved by the Ministry of Petroleum and Natural Gas. Administration of the SPE discipline was being monitored by OCC. Over the years, IOC's share of market participation came down to 54%.

As an extension of SPE, the four marketing companies were also mutually preparing marketing plans which set out companywise annual rosters of new MS/HSD retail outlets to be put up, new LPG markets to be entered, additional product dealerships/distributorships to be set up, etc.

With decontrol of products catering to large consumer business effective 1st April, 1998, the SPE concept has virtually become invalid. Barring kerosene, the other remaining administered products are available to PSUs in the quantities they require to sustain their respective marketing networks. However, the SPE ratios between PSUs are still used as a guide for the purpose of drawing up PSUs' marketing plans until this practice also gets discontinued shortly in anticipation of full deregulation from 1st April, 2002.

4.1.4 *Inter-company product exchange, sale and hospitality*

The pool of available administered products in the country from all refineries and LPG Fractionating plants, as well as imports to cover deficit products, is shared between the PSUs. Each refinery, regardless of its ownership or right of sale for products, is open to all PSUs for drawing their requirements. Similarly, each oil company has a call on the imported products, though all imports are being canalised through IOC. The sourcewise and productwise share out of each oil company is regulated through the monthly supply plan discipline.

Product exchange

The three integrated oil companies, viz. IOC, HPCL and BPCL draw supplies of products from each other's refineries, including those where they have right of sale agreements, under Product Exchange arrangement. No inter-company charge is levied on supplies drawn directly ex-refineries. However, at a few refinery locations, oil companies operate a separate terminal from where supplies are made instead of the refinery. For supplies drawn through such a terminal, Main Installation (MI) specific charges are payable to the company operating the Terminal as per current administered pricing system. Imbalances on the quantum of products exchanged at refinery locations between the three oil companies are regularly reconciled and raised to purchase sale account.

IOC/HPCL/BPCL may need to take product assistance from each other at Port Terminals from products received through imports or moved by tankers from coastal refineries. For such assistance, the receiving company pays MI specific charges besides accounting for basic cost of product.

Imported products

These are handled by the canalising agent, IOC by availing of coastal facilities of all oil companies at the ports of receipt. The receiving company pays IOC for the imported product thus supplied and uses the product for its own sales.

Supply of products from pipeline TOPs/terminals

Most of the existing product pipelines are owned and operated by IOC, with the exception of HPCL's Mumbai-Pune, BPCL's Mumbai-Manmad and HPCL's Vishakh-Vijayawada pipelines. For product supplies drawn by the PSUs from pipeline TOPs/Terminals of other companies, they pay MI Specific charges plus a small unit flat charge to the company owning the pipeline.

Product purchase

IBP do not have a refinery at present and have been selling products as independent marketers primarily for the retail trade through their own networks of MS/HSD retail outlets and Kero/LDO distributors. Their participation in sales to direct consumers is minimal and they have recently entered LPG marketing.

Products are purchased by IBP from the other PSUs under purchase arrangements which involve conceding a share of specific costs to the other PSUs from their margins under the current administered pricing system, besides payment for basic cost of products.

IBP own a small number of storage and distribution facilities and largely rely on the integrated oil companies to procure their product requirements.

Hospitality

Prior to 1967, the infrastructure of the then Multinational companies as well as IOC for marketing and distribution of petroleum products was independent of each other due to competitive nature of business. At product receiving stations, like inland depots, the railway siding facilities were also separate and small, designed for piecemeal movement of rail tankwagons which resulted in their poor turnaround. With the Railways desire to move petroleum products in full trainloads and thus improve turnaround of tankwagons, the oil companies were asked to integrate their siding facilities to avoid shunting of tankwagons. This set into motion integration of oil companies' inland depots at various locations and a loose hospitality arrangement for product handling between the companies was introduced. After all oil companies became national companies, the process was further strengthened.

Hospitality arrangement between HPCL and BPCL got enlarged by mutually designating one of the two companies on a reciprocal basis to take over operation of the other company's depot facilities at some selected stations. The arrangement involves storage, safe custody and delivery of the other company's products to its dealers/distributors/customers, as per directive and under the respective invoice of the other company. For such an hospitality, the company receiving hospitality pays an agreed unit charge and also bears a set percentage of transit and operational product losses. The overall quantum of hospitality so rendered between the two companies on a reciprocal basis is periodically reconciled and settlement made for the imbalance.

With the trading volumes getting enlarged, BPCL and HPCL now prefer to have independent storages and the hospitality volumes at inland depots are on the decline.

4.1.5 Freight surcharge pool

Prior to the first phase of the notified deregulation plan taking effect from 1-4-1998, pricing of most petroleum products except few free trade products like Lubes and Bitumen was controlled on the basis of recommendations of Oil Prices Committee, 1976 as approved by the Ministry of Petroleum and Natural Gas (MOP & NG) vide its order dated 16-12-1977 which was subsequently amended vide order dated 23-10-1986.

Under the above orders, refineries were treated as primary pricing points having uniform productwise ex-refinery prices irrespective of whether a refinery was situated at any coastal location or inland. Productwise selling rates ex other storage points i.e. port terminals, pipeline TOPs and terminals as well as inland installations and depots were fixed by taking into consideration the nearest refinery from each storage location as the base and allowing therefrom a national freight or transport charge upto the storage location, besides the applicable local duties and taxes. The basis used for computing the notional frieght or transport charge was by rail or other specified means of transport. The selling rates for dealers operating the marketing companies authorised retail outlets for motor spirit and HSD market were further fixed by adding to the nearest storage location prices of these two products a standard delivery charge by road and the applicable local duties and taxes in that market.

In actual practice, supplies of products to storage points may not necessarily move from the respective nearest refineries. Out of refinery zone movement of products is, in fact, a regular feature. Also, at times the mode of transport used for calculating the notional freight, e.g. rail may not be available to promptly move the products in adequate quantities from a refinery to the storage point warranting bridging of part volumes by a costlier mode like road transport. Furthermore, the public sector companies have not been always allowed to fully recover increases in delivery costs over the years for supplying motor spirit and HSD from storage locations to their retail outlets by road. All such under-recoveries on freight and delivery charge are being reimbursed to the public sector companies from a pool account through the levy of freight surcharge on products in the administered pricing system. The claims being lodged by the public sector companies for the above reimbursements from the freight surcharge pool account run into large amounts.

Decontrolled products no longer qualify for any assistance from the freight surcharge pool which now deals with claims related to only the remaining administered products.

4.1.6 *Role of Oil Coordination Committee (OCC)*

Although the four PSUs are separate organisations, they are effectively controlled by the Ministry of Petroleum and Natural Gas, which not only sets overall industry policies and regulations (e.g. regarding pricing) but also directly coordinates activities of these companies and approves investments and expenditures. To assist the Ministry in the task of coordination, the `Oil Coordination Committee' (OCC) was set up in the year 1975 with the Secretary, Ministry of Petroleum and Natural Gas as its Chairman and the Chairmen and Managing Directors of each PSU as its members. The Executive Director of OCC acts as its Member Secretary. The staff in OCC is generally taken on short term deputation from existing staff of PSUs in various functions.

OCC presently functions as an apex body for planning and monitoring of activities related to refining, marketing and distribution of petroleum products through the PSUs. It prepares forward demand estimates, plans for increase in refining capacity, draws up estimates of crude and product imports as well as necessary product exports and takes stock of the required expansion in infrastructural support from all agencies, including storage, distribution and allied facilities of the PSUs, to sustain the growth in demand. In the short term, it plans for supply of indigenous and imported crude oil for existing PSU refineries in line with the processing requirements, establishes source of supply for import of deficit products, prepares monthly supply plan for supply and distribution of administered petroleum products within the country and monitors execution of these plans. It is also associated with regulation of prices of the remaining administered petroleum products, fixation of retention margins for these products and operation of pool accounts under the present administered pricing system.

4.1.7 Monthly supply-distribution plan (SPM)

The process of preparing supply-distribution plan starts with the formulation of annual estimate of demand for each product by OCC well before the beginning of the year. This demand estimate is then viewed in relation to the availability of crude oil and refining capacity within the country to determine the overall requirement of imports of crude oil and specific refined products during the annual period. Need for export of any surplus indigenous product is also simultaneously established. On the finalisation of this estimate, negotiations for tying up imports of crude oil and products are taken in hand well in advance.

Planning for actual supply and distribution of administered products is carried out on an integrated basis so as to minimise overall distribution cost while ensuring that there are no product dry-outs in any area or product containment problems at any port/refinery location. For this purpose, detailed discussions are held at the monthly Industry Coordination Meeting (ICM) and the monthly supply plan meeting (SPM), based on detailed exercises.

ICM

Industry Coordination Meeting is conducted by OCC every month, wherein overall demand of petroleum products, availability of crude oil, refinery-wise production plans including joint venture and private sector refineries, inventory of petroleum products and imports are considered. A Macrolevel study of the supply and demand is carried out, so as to arrive at surpluses for exports and deficits for imports. This exercise is done well before the commencement of the month. Further Microlevel details of the distribution plan are worked out by the industry at the SPM.

SPM

The industry once again meets, every month, shortly after the ICM, to work out a detailed plan for supply and distribution of petroleum products in respect of each storage location.

This a complex task, bearing in mind that:

- Demand spread over a vast area is fed from a large number of storage locations;
- Centres of product availability for despatches to other supply locations are the refineries, port terminal locations where products can be positioned by ocean tankers either coastally or by imports and pipeline TOPs as well as terminals;
- The products can be moved by various modes, namely ocean tankers, cross-country and local pipelines, tankwagons on broad gauge and meter gauge, tank trucks and barges.

The objective is to produce an optimal distribution plan that will minimise the cost of transportation of products, taking due account of the constraints that exist in the infrastructural facilities. For this purpose, the industry uses a computer model called CRISPLAN (Computerised Rolling Industry Supply Plan), using linear programming technique. The model optimises the movement plan of bulk petroleum products from refineries and major stocking points, including ports, to various demand centers by meeting full product requirement, subject to availability. Any shortfall in availability is shown against the main ports for import decisions.

Under the current pricing system for administered products, transport costs on normal movement of products by recognised modes of transport within a defined pricing zone are recovered by the oil companies through the authorised selling rates. In cases where out of zone rail movement of products takes place as per SPM, compensation for the extra cost incurred on such movement is claimed by oil companies through the freight surcharge pool accounts. Similarly, compensation for higher cost of bridging products by road to storage locations, as approved in the SPM, due to shortfall in rail movement, is also sought from the pool account. Claims for compensation of unrecovered delivery charges for delivering motor spirit and HSD to retail outlets through tank-trucks are submitted likewise by the public sector companies.

The following monthly inputs relating to administered products are required to be fed for operation of the model, which is done by the industry.

- Refinerywise/productwise production
- Expected opening stocks, productwise and basewise
- Sectorwise opening line fills of cross country pipelines
- Desirable limits of closing stocks, productwise and basewise
- Sectorwise closing line fills of cross-country pipelines
- Destinationwise/productwise demand at each storage location
- Aviation Fuel Station-wise demand for jetfuel.

The model provides, *inter alia*, the following important outputs:

- Basewise plan giving details of all the transactions that take place in that loading base for the month, which include:
  - Distribution plan indicating the productwise, modewise movement to each destination supplied by the base
  - Average daily tank wagon loading target
  - Rail loading plan identifying the number of trainloads in each direction from the base
  - Companywise tank wagon share-out for each direction.
- Destinationwise/Companywise tabled demand of products along with details of productwise source of supply and mode of transport, including Aviation Fuel station-wise tabled demand for jetfuel, its source of supply and mode of transport
- Coastal / Import plan
  - Productwise movement from each load-port to each discharge port
- Pipeline pumping/delivery plan
  - Productwise monthly delivery plan for delivery points and the pumping plan productionwise from each supply source.
- Road movement plan
  - Bridging by road from the various loading bases for selected products like MS, kerosene, HSD and jetfuel.

The SPM is chaired by a representative of the Ministry of Petroleum and Natural Gas and is attended by members of OCC, the oil industry including representatives of joint venture and private sector refineries and the railways. After discussion and finalisation, the Supply Plan is issued by OCC as an official document on the strength of which oil companies claim compensations from different pool accounts maintained by OCC. Deviations, if any, from the Plan have to be approved by OCC. Implementation of the Supply Plan is monitored by OCC.

4.1.8 *Impact of implementation of first phase of deregulation plan effective 1-4-1998 on supply plan mechanism*

The following developments have taken place:

a) The supply plan is prepared only for the remaining administered products, viz. LPG (for domestic consumers), motor spirit, kerosene (for PDS), jetfuel, HSD and NGL condensate in the prevailing SPM format which is now authorised by OCC. Authorised road bridging plan for administered products only constitutes a part of the SPM. Methodology for settling companywise claims under authorised bridging plan from the freight surcharge pool has been restated by OCC.

b) A separate 'Industry Logistics Plan' (ILP) for decontrolled products other than those mentioned under (a) above, is drawn up by PSUs and movements planned through ILP do not have any reflection on the Oil Pool Account. Any under/over-recoveries in freight etc. on decontrolled products are on PSUs' account.

c) OCC continue to coordinate with Ministry of Surface Transport and major ports as well as Ministry of Railways and other concerned Ministries in respect of movement of all petroleum products. However, the responsibility for marketing and transportation of all deregulated products by all modes rests with the PSUs effective 1st April 1998.

d) Whereas OCC's services/resources may be utilised by the industry, there is no liability on the pool accounts for any such movements in terms of operation as well as costs.

4.1.9 *General*

Information contained in this Section 4.1 is meant to serve as a background while going through the subject of jetfuel supply logistics starting from the following section 4.2

It may be added that at present, the average tankage capacity of 25 days of product demand is provided for. The oil companies have now stopped increasing the tankage capacity.

4.2 Jetfuel supply sources

As stated in Chapter 3, demand of jetfuel in the next decade is likely to be fully met from its production in the existing and proposed refineries in the country. Figure 4.1 shows the location of existing, under construction and proposed refineries, of which those considered for jetfuel production are as follows:

Coastal refineries

All existing coastal refineries, except Mangalore refinery, produce jetfuel. Mangalore refinery is equipped to produce jetfuel, subject to sufficient upliftment. The Essar refinery under construction at Vadinar on the west coast and the refineries to be put up at Cuddalore and Paradeep on the east coast will also be capable of making jetfuel.

Inland refineries

Th existing inland refineries at Mathura and Panipat in the northern region and at Koyali in the western region produce jetfuel. The proposed central India refinery at Bina in the western region and at Bhatinda in the northern region will also be producing jetfuel.

In the eastern region, whereas the existing Bongaigaon refinery makes jetfuel and the recently commissioned Numaligarh refinery is beginning to produce jetfuel, the existing refineries at Digboi, Gauhati and Barauni do not make this product.

Forward availability of jetfuel from the above refineries is given in Table 3.6 of Chapter 3.

4.3 Jetfuel despatch facilities at existing refineries and associated marketing terminals

At some refinery locations, separate marketing terminals put up in the vicinity of the refineries participate in storage and despatch of products. The following Table 4.3 provides a list of jetfuel producing refineries along with locations of the associated marketing terminals handling jetfuel:

Table 4.3 List of refineries manufacturing jetfuel and associated marketing terminals

Refinery location	Refinery owner	Marketing terminal location	Terminal operator
Coastal refineries			
Mumbai	BPCL	-	-
Mumbai	HPCL	Mahul	HPCL
Mumbai	-	Sewree	IBP (for IOC)
Jamnagar	RPL	Near refinery	Subsidiary of RPL
Cochin	CRL	W. Island	IOC
Chennai	MRL	Tondiarpet	IOC
		Tondiarpet	BPCL
		Tondiarpet	HPCL
Vishakh	HPCL	Near refinery	IOC
Haldia	IOC	-	-
Inland refineries			
Mathura	OPC	Near refinery	IOC
*Panipat	IOC	-	-
Koyali	IOC	-	-
Bongaigaon	BRPL	-	-
#Numaligarh	NORL	Near refinery	NORL

* Refinery tankage connected to Mathura-Delhi-Ambala-Jullundur products pipeline
# To start production shortly

The above refineries have varied jetfuel despatch facilities, as required at each location, for pumping jetfuel through local or long distance product pipelines, loading it into tankers at coastal locations as well as loading jetfuel in full rakes of rail tankwagons and into road tank-trucks. Similar primary or complementary despatch facilities exist at the corresponding marketing terminals of PSUs depending upon the extent of jetfuel despatches handled directly from each refinery. In addition, the marketing terminals at the coastal location Tondiarpet in Chennai are equipped to receive small tanker parcels of jetfuel from other coastal refineries or, if required, through imports.

Jetfuel tanks at all marketing terminals are epikote lined, fit for jetfuel storage. The loading and discharge lines are flushed as per standard laid down practices so as to maintain product specification and ensure quality control.

4.4 Jetfuel import facilities

It is evident from Chapter 3 that availability of jetfuel will remain surplus to its demand in the country beyond the year 2010. No import of this product is thus envisaged during the period under consideration.

In the likely event of jetfuel import becoming necessary at any stage, the PSUs are in a position to undertake it at their Kandla, Vasco and Budge Budge port terminals and at their Chennai marketing terminals, as stated under section

4.2 above. The three port terminals normally receive jetfuel supplies in tanker parcels from coastal refineries.

In view of inadequate jetfuel tankage at these port and marketing terminals individually, an MR vessel could be received on two or multi-port discharge basis. Indeed, such an arrangement was resorted to when an odd jetfuel import was required some time back. However, it is logical to assume that PSUs will go for such imports only to meet their own needs and it is highly unlikely that they will offer the use of their jetfuel storage and other import facilities for any private marketer after deregulation, by jeopardising their own trading interests. Even the existing product sharing arrangements between PSUs themselves are going to come under strain post deregulation and the shape of swap deals or revised hospitality arrangements emerging thereafter remains to be seen.

Development of product storage terminals by private parties for use by interested private marketers of petroleum products presently on free trading list is in its initial stages. Indian Oil tanking Ltd. – a joint venture company of the multinational 'Oiltanking' of Germany with some Indian PSUs - has set up such a product terminal at a short distance from the new Nhava Sheva port near Mumbai. Another company, 'East India Petroleum Ltd.' has put up a products terminal at Vishakhapatnam where they have subsequently also installed a few LPG spherical storage tanks with equity participation by the multinational company 'SHV Energy' which has entered LPG marketing in India. Aegis Chemical Industries Ltd., Mumbai have been operating product terminaling business for sometime in the Mumbai port area of Trombay though they deal more in the petrochemicals field and have lately added LPG to their list of products. A couple of other small private terminal operators at Kandla and some other port are also reportedly entering the fray. None of these operators presently handle jetfuel but one or two of them may feel interested to take up this task, if it proves remunerative.

A general idea of the type of vessels used and parcel sizes of products (other than jetfuel) presently imported into India is given as follows:

Product imports: Vessel sizes and parcel sizes

The ports which have been receiving imported product parcels in India so far are: Kandla, Mumbai and Vasco (Goa) on the West Coast and Chennai, Vishakhapatnam, Paradip, Haldia and Budge Budge on the east coast. Vessel sizes generally used for imports are of the following order:

West coast

40,000 MT and above (LR1) and 30,000 MT (MR). These tankers can be directly received at Mumbai and Vasco. Due to smaller demand and limited tankage, tankers are only partly discharged at Vasco.

Import vessels of around 40,000 MT can be received at Vadinar lighterage pont and after lighterage, both the mother and daughter vessels proceed for discharge at Kandla port. Smaller vessels may be directly berthed at Kandla.

East coast

40/50,000 MT and above (LR II)-----90% and below 40,000 MT.......10%.

Import vessels as above can be directly received at Chennai and Paradeep. However, they are only partly discharged at Paradeep because of smaller demand.

Import vessels for Vishakhapatnam are received at New Oil Mooring (NOM) outside the port and are lightered there before being taken in for discharge. The daughter vessel can then proceed to another destination.

Because of lower draft, Haldia cannot receive fully loaded parcels. Lighterage is done at Chennai, Vishakhapatnam or Paradeep before proceeding to Haldia.

Budge Budge has still lower draft and can receive import parcels after lighterage of cargo up to 14,000 MT maximum in a tanker of 30,000 MT or alternatively through a small daughter vessel of 5/6,000 MT.

4.5 Jetfuel distribution

Supplies of jetfuel have to reach more than 65 Aviation Fuel Stations (AFSs) handling civil air traffic spread over a vast area throughout the country. A network of suitable jetfuel storage points is being deployed by PSUs to feed the AFSs. The network is a part of their much bigger distribution infrastructure in use for meeting consumer needs of transportation fuels and all other petroleum products throughout the country. Apart from the jetfuel producing refinery locations and some port terminals, the jetfuel storages have, in fact, been set up only at those selected upcountry petroleum products installations and depots of the oil industry from where it is expedient to make jetfuel deliveries to nearby AFSs.

The modes of transport used for moving jetfuel from supply sources to jetfuel storage points and thereafter to AFSs, are the same as for other white oils i.e. by tankers for coastal movement, through local and long distance product pipelines, by rail in tank wagons and by road in tank trucks. However, maintenance of jetfuel product quality being of paramount importance, special care is taken to ensure that the product does not go off-specification during transportation.

Notable movements of jetfuel currently being undertaken by each mode of transport are described as follows:

Coastal movement

Table 4.4 List of port terminals receiving jetfuel supplies from Coastal refineries

Terminal location	Operating company	Jetfuel supply source
Kandla	HPCL	BPC and HPC refineries, Mumbai
Vasco	IOC	BPC and HPC refineries, Mumbai
Budge Budge	IOC	
	BPCL	Haldia refinery
	HPCL	
Port Blair	IOC	Haldia refinery

Note. Since the jetfuel tankages available at the above port terminals are small, only part jetfuel parcels are sent through tankers. Smaller barges are used for jetfuel coastal movement ex Haldia refinery, particularly to Port Blair.

Local pipelines

Jetfuel is transferred by pipeline from refinery tankage to jetfuel storage at a local marketing terminal and onward despatch from there as per PSUs' distribution plan. Implementation of the distribution plan is done between the refinery and the local marketing terminal(s) in a coordinated manner. Transfer of Chennai refinery jetfuel production through a pipeline to the PSUs' marketing terminals at Tondiarpet in Chennai is one such example.

Pipelines also carry jetfuel locally from refinery jetfuel storage or similar size storage at non-refinery location to a major AFS requiring large quantities of jetfuel. Two such examples are given in the following Table 4.5.

Table 4.5 Jetfuel movement through local pipelines

Supply location	Pipeline owner	Receiving AFS	Category of air traffic handled at the AFS
Bijwasan, Delhi tap-off-point on Mathura-Delhi-Ambala-Jullundur products pipeline	a) BPCL, who also own and operate a Hydrant System at the AFS	Indira Gandhi International Airport, Delhi	International
	b) IOC	Palam Airport, Delhi	Domestic
HPC and BPC refineries, Mumbai	HPCL, who also own a hydrant system at the Domestic airport which is	Both the Domestic and International airports at Mumbai	Domestic and International

Supply location	Pipeline owner	Receiving AFS	Category of air traffic handled at the AFS
	still not fully operative.	Besides delivering product into HPCL storage at the AFS, the pipeline is also connected with BPCL and IOC tankages at the Domestic and International airports. IOC own and operate a Hydrant system at the International airport	

Long distance product pipelines

A number of these pipelines are in use in India and their salient features are given in Table 4.2 With the exception of two relatively shorter distance pipelines, the others have tap-off-points (TOPs) enroute. Productwise storage of suitable size is provided at each TOP and at the pipeline terminals to sustain smooth operation of the pipelines.

A few more pipelines as shown in Figure 4.1 are either under construction or under active planning. This figure also shows the existing pipelines and those carrying jetfuel (in bold). A list of TOPs and Terminals on the pipelines presently carrying jetfuel is provided in the following Table 4.6

Table 4.6 List of TOPs and Termination Product pipelines carrying jetfuel

Pipeline	Owner/Operator	TOP /Terminal locations
Mathura-Jullundur	IOC	- Bijwasan (Delhi) - Ambala - Jullundur terminal
Koyali-Sabarmati	IOC	No TOP. - Terminal at Sabarmati (Ahmedabad)
Haldia-Rajbandh	IOC	- Mourigram - Rajbandh terminal

In the past, Haldia-Barauni-Kanpur pipeline was also used to transport jetfuel but discontinued due to the pipeline having been used in between for transporting Light Diesel Oil (LDO). For the same reason, Mumbai-Pune pipeline is debarred from carrying jetfuel. The other existing pipelines and those under construction or now proposed could be considered for jetfuel movement, if required.

Jetfuel transported through the above pipelines is received at their TOPs/Terminals into epikote lined jetfuel storage tanks to maintain product quality.

Jetfuel transportation through product pipelines belonging to PSUs is presently being done exclusively to meet PSUs' own requirements. It is expected that post deregulation, usage of product pipelines will also become available to private marketers on a common carrier basis.

Rail tank-wagons

This mode of despatch is used for transporting jetfuel from supply locations generally in full rake-loads to jetfuel storages at upcountry installations and depots which store and distribute various petroleum products. Dedicated epikote lined jetfuel storage tanks of adequate capacity are separately maintained at such select installations/depots to receive full rake-loads which are unloaded through exclusive discharge lines always kept full with jetfuel so as to avoid any contamination during decantation. A rake-load of 70 tankwagons of 20 MT capacity each carries approximately 1400 MT of jetfuel. The rail tankwagons employed for jetfuel transportation are also used for Kerosene and High Speed Diesel, with the proviso that the last load carried in the rake must be of Kerosene. Such tankwagons are flushed again with kerosene prior to jetfuel loading and must pass the quality control test for jetfuel before being declared fit to carry jetfuel. Product loaded in any suspect tankwagon is downgraded for use as Kerosene.

Major inland installations/depots and other storage locations receiving jetfuel supplies by rail tankwagons are listed in the following Table 4.7. These locations are also shown in Figure 4.1.

Table 4.7 Major inland installations/depots receiving jetfuel supplies by rail

Storage location	Supply source
Northern Region	
Shakurbasti, Delhi (Inland terminal)	Koyali refinery
Palam, Delhi	Koyali refinery
Jammu	Jullundur Terminal
Ambala (jetfuel receipts at this depot are supplementary to jetfuel receipts by pipeline at Ambala TOP)	Koyali refinery
Jodhpur	Kandla Port Terminal
Allahabad TOP (No longer receiving jetfuel through Haldia-Barauni-Kanpur pipeline)	Koyali refinery
Panki, Kanpur (TOP) (No longer receiving jetfuel through Haldia-Barauni-Kanpur pipeline)	Koyali refinery
Western Region	
Rairu, Gwalior	Koyali refinery
Khapri, Nagpur	Koyali refinery
Southern Region	
Sanatnagar & Cheralapalli, Hyderabad	Chennai refinery/ Tondiarpet Marketing Terminal
Bangalore	Chennai refinery/ Tondiarpet Marketing terminal
Thiruvanthapuram	Chennai refinery/ Tondiarpet Marketing Terminal
Eastern Region	
Missamari (by rail meter gauge)	Siliguri Pipeline terminal and Bongaigaon refinery

Road tank-trucks

At some of the jetfuel storage locations where large scale jetfuel movement by road is a regular feature and the quantum to be transported is well determined, the PSUs have contract arrangements for use of exclusive tank-trucks fitted with epikote lined bulk tanks. Bulk of jetfuel transportation by road is, however, done through contracted tank-trucks which are engaged in carrying white oil products like Kerosene and High Speed Diesel but not Motor Spirit. The tanks of such vehicles are flushed with Kerosene till they become fit for loading jetfuel. Carrying capacities of these tank-trucks range from 10-15 MT each and the PSUs enter into periodic transport contracts with third party contractors for use of these vehicles in large numbers for carrying specified petroleum products. A number of big and small AFSs receive jetfuel supplies through tank-trucks direct from refineries producing jetfuel or their associated marketing terminals. jetfuel deliveries are made from the tank-trucks into jetfuel storage at each AFS after prescribed checks on product quality.

4.6 Existing and prospective linkage of major AFSs with jetfuel supply locations

Figure 4.2 showing the location of over 65 AFSs catering to civil air traffic in the country indicates that these AFSs are spread over the entire length and breadth of the country. The PSUs are using a part of their vast distribution infrastructure to supply jetfuel requirements of these AFSs by positioning the product at a number of storage locations closer to the AFSs, as described in Section 4.5.

The manner in which jetfuel supplies presently reach the major AFSs has been examined under different categories of select 20 airports which currently represent the bulk of the total jetfuel sales. jetfuel supply linkages to some of these airports may change as new refineries and product pipelines come into existence. Prospects for such indicated changes in supply linkages have been broadly identified to make a forward assessment of the emerging jetfuel distribution scenario.

The position obtaining at the select AFSs is outlined in the following sub-sections according to the type of airports where these AFSs are located.

4.6.1 *International Airports*

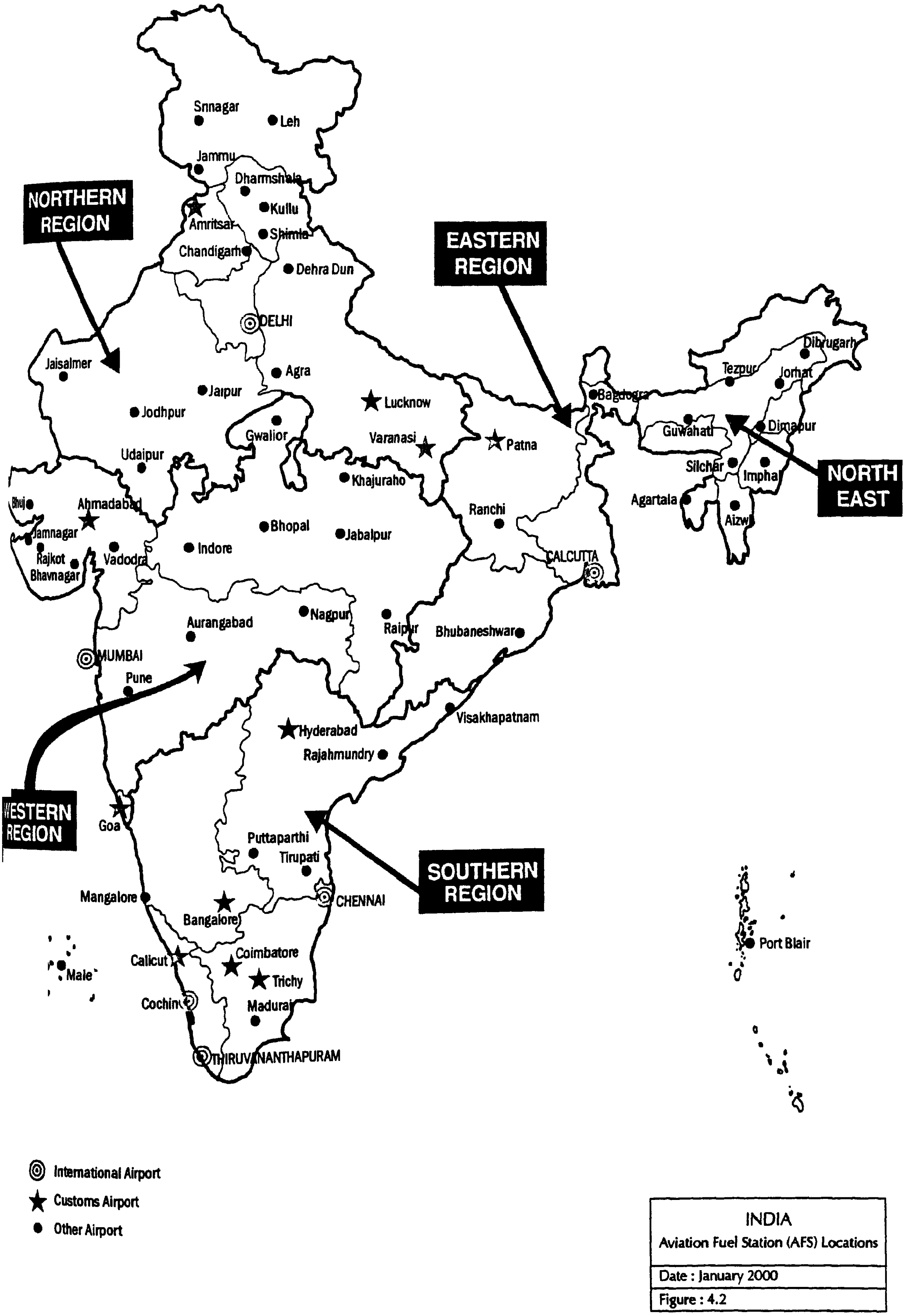
All the airports under this category also cater to large domestic air traffic, either from adjacent or different airport terminals in vicinity. Notwithstanding the title of this category, a coordinated picture of jetfuel supplies for both the international and domestic wings is furnished in the following Table 4.8.

Table 4.8 Jetfuel supply linkages for International Airports

Airport location	Present supply linkage		Prospective supply linkage
	From	To	
1. Indira Gandhi International Airport, Delhi	Mathura refinery	Bijwasan, Delhi TOP - (through Mathura-Jullundur pipeline)	No change
	Bijwasan TOP	a) IGIA - (through local pipeline of BPCL)	
		b) Palam Airport - (through local pipeline of IOC)	No change
Palam Airport (Domestic), Delhi	Koyali refinery	Shakurbasti, Delhi inland terminal - (by rail TWs)	Present arrangement is likely to continue, at least to meet part requirements of Palam airport.
	Shakurbasti terminal	Palam Airport - (by road TTs)	Long term, when Panipat refinery gets expanded and Bhatinda refinery materialises, there will be no need to carry jetfuel production of Mathura refinery beyond Bijwasan. This may result in bigger jetfuel receipts at Bijwasan to meet Palam Airports' requirements to a larger extent through the IOC pipeline.
2. Sahar International Airport, Mumbai Santacruz Airport (Domestic), Mumbai	HPCL and BPCL refineries, Mumbai	Santacruz and Sahar airports - through local pipeline of HPCL	No change
3. Chennai International/Domestic Airport	Chennai refinery/ Tondiarpet marketing terminals	Chennai Airport - by road TTs	No change
4. Thiruvanthapuram International Airport	Cochin refinery and partly, Chennai refinery	Thiruvanthapuram Airport - by road TTs	No change
		Thiruvanthapuram depot - by rail TWs	May be discontinued after Cochin refinery expansion materialises
	Thiruvanthapuram depot	Thiruvanthapuram airport - by road TTs	
5. Dum Dum, Calcutta International/ Domestic Airport	Haldia refinery	Mourigram TOP - through Haldia - Mourigram - Rajbandh pipeline	
	Mourigram TOP and partly, Haldia refinery	Dum Dum Airport - by road TTs	No change
		Budge Budge port terminals - by barges	No change
	Budge Budge port terminals	Dum Dum Airport - by road TTs	No change

4.6.2 *Customs Airports*

This category constitutes the second stage airports to which some of the international air flights proceed, mostly after first landing at a regular International Airport, so as to give passengers the facility to disembark and clear through customs at the second stage airports. Similarly, the international flights starting from the second stage airports first land at a regular International Airport before proceeding further.



INDIA
Aviation Fuel Station (AFS) Locations

Date : January 2000
Figure : 4.2

All the customs airports handle domestic air traffic, including some locations where the volume of domestic traffic is fairly large. Jetfuel supply linkages for these airports are described in Table 4.9.

Table 4.9 Jetfuel supply linkages for Customs Airports

Airport location	Present supply linkage		Prospective supply linkage
	From	To	
Northern Region			
1. Varanasi	Koyali refinery	Allahabad TOP - by rail TWs	Jetfuel supplies by rail TWs to Allahabad TOP may shift to the closer Bina refinery after its materialisation
	Allahabad TOP	Varanasi Airport - by road TTs	
2. Lucknow	Koyali refinery	Allahabad or Panki, Kanpur TOP - by rail TWs	Jetfuel supplies by rail TWs to Allahabad/Panki TOPs may shift to the closer Bina refinery after its materialisation
	Allahabad/Panki TOP	Lucknow airport - by road TTs	
3. Amritsar	Mathura refinery	Jullundur Terminal - through Mathura - Jullundur pipeline	Long term, after materialisation of Bhatinda refinery, Jullundur will receive jetfuel supplies from Bhatinda through a pipeline link planned from there to Jullundur
	Jullundur Terminal	Amritsar Airport - by road TTs	
Western Region			
4. Ahmedabad	Koyali refinery	Sabarmati, Ahmedabad - through Koyali - Sabarmati pipeline	No change
	Sabarmati Terminal	Ahmedabad Airport - by road TTs	
5. Goa	Mumbai refineries	Vasco port terminal - through coastal movement by tanker	No change
	Vasco terminal	Dabolim Airport, Goa - by road TTs	
Southern Region			
6. Bangalore	Chennai refinery/ Tondiarpet marketing terminal	Bangalore inland terminal - by rail TWs	On commissioning of Mangalore - Bangalore pipeline (construction is to start shortly), Jetfuel despatches to Bangalore may be routed through this pipeline instead of by rail ex Chennai. Mangalore refinery will then start producing jetfuel on a regular basis
	Bangalore inland terminal	Bangalore Airport by road TTs	
7. Hyderabad	Chennai refinery/ Tondiarpet marketing terminal	Sanatnagar & Cheralapalli, Hyderabad depots - by rail TWs	A new airport on an international scale at Hyderabad is under active development. Plans are also afoot to extend the Vishakh - Vijayawada pipeline to Hyderabad. Jetfuel movement to Hyderabad through this pipeline may well be on the cards, subject to availability of jetfuel in adequate quantities ex Vishakh refinery
	Sanatnagar & Cheralapalli depots	Hyderabad airport - by road TTs	
8. Coimbatore	Cochin refinery	Coimbatore Airport - by road TTs	Volume of air traffic at Coimbatore may not be large enough to justify transporting jetfuel through the Cochin-Coimbatore-Erode-Karur pipeline presently under construction
9. Calicut	Cochin refinery	Calicut Airport - by road TTs	Mangalore refinery is equally suitable to supply jetfuel to Calicut airport, subject to regular jetfuel production starting at this refinery if jetfuel movement to Bangalore is undertaken through the Mangaloe Bangalore pipeline on its completion
10. Trichy	Chennai refinery	Trichy airport - by road TTs	On its materialisation, Cuddalore refinery will be a closer supply source for Trichy Airport
Eastern Region			
11. Patna	Haldia Refinery	Rajbandh Terminal - through Haldia - Morigram - Rajbandh pipeline	No change
	Rajbandh Terminal	Patna Airport - by road TTs	

4.6.3 Few other select airports and airports in North-East

Jetfuel supply linkages for a few other select airports are given in Table 4.10 below.

Table 4.10 Jetfuel supply linkages for other select airports

Airport location	Present supply linkage		Prospective supply linkage
	From	To	
1. Cochin new airport (commissioned recently	Cochin refinery	Cochin new airport - by road TTs	No change
2. Nagpur	Koyali refinery	Khapri, Nagpur depot - by rail TWs	The projected Central India pipeline starting from Jamnagar and Vadinar refineries to Ratlam, Itarsi and Nagpur via Koyali refinery may carry jetfuel to Nagpur
	Khapri depot	Nagpur Airport - by road TTs	
3. Jammu	Jullundur Terminal on Mathura - Jullundur pipeline	Jammu depot - by rail TWs	Mathura - Jullundur pipeline is likely to be extended to Jammu via Amritsar and Pathankot. On materialisation of Bhatinda refinery, it will get hooked to Jullundur terminal by a pipeline and jetfuel from Bhatinda refinery may thus move by pipeline to Jullundur and further to Jammu along with other white products
	Jammu depot	Jammy Airport - by road TTs	
4. Bhubaneshwar	Haldia refinery	Bhubaneshwar Airport - by road TTs	On its materialisation, Paradeep refinery will be closer to Bhubaneshwar

Jetfuel supplies to airports in North-Eastern part of Eastern Region

Rail and road communications in the north-eastern pocket are circuitous and difficult due to its terrain and substantial portion of its rail tracks being on metre gauge which is under conversion to broad gauge. For quick access to the north-east, travel by air is a vital link which is demonstrated by the existence of a concentration of nine civil airports in the area, as shown in Figure 4.2.

Out of the three small refineries operating in north-east, based on limited supply of indigenous crude oil available in the north-eastern pocket, only Bongaigaon refinery produces jetfuel. Since its jetfuel production is inadequate to meet the full demand in that area, jetfuel supplies are supplemented from Haldia refinery in the following manner:

From	To
Haldia refinery	Rajbandh Terminal - Through Haldia - Mourigram - Rajbandh pipeline
Rajbandh Terminal	Siliguri Terminal on Guwahati - Siliguri pipeline - by rail TWs
Siligun Terminal	a) Few stroage depots in north-east - by rail TWs and b) A nearby Airport - by road TTs
Storage depots in north-east	Airports in their vicinity - by road TTs

However, the new north-eastern refinery at Numaligarh will start producing jetfuel shortly to make up the shortfall in that area. Despatches of jetfuel from Haldia in the manner described above will be discontinued thereafter.

5

Infrastructure at major airports

Introduction

Airports are presently classified as follows:

International airports: These are available for scheduled international operations by Indian and foreign carriers. Currently, Delhi, Mumbai, Chennai, Calcutta, Cochin and Thiruvanthapuram fall in this category.

Custom airports: These have customs and immigration facilities for limited international operations by domestic carriers and for foreign tourists and cargo charter flights. Bangalore, Hyderabad, Ahmedabad, Calicut, Goa, Varanasi, Patna, Agra, Jaipur, Amritsar and Tiruchirapally are included here.

Domestic airports: Domestic airports which have minimum runway length of 7500 feet and adequate terminal capacity to handle airbus 320 type aircrafts belong to this category. These can handle limited international operations, if required. These include Lucknow, Bhubaneshwar, Guwahati, Nagpur, Vadodra, Coimbatore, Imphal and Indore.

Other domestic airports: All other airports are covered in this category.
Civil enclaves in Defence airfields
In addition to the six international airports, there are 86 domestic airports and 28 civil enclaves. The latter are essentially defence airfields, where civilian flights are also allowed.

The top five airports at Delhi, Bangalore, Mumbai, Chennai and Calcutta handle nearly 75% of the total air-traffic. Ten other airports including Hyderabad, Thiruvanthapuram, Ahmedabad, Cochin account for 16% of the traffic. Of the total jetfuel sales of 2097 TMT in 1998/99, IOC had a predominant share of 70% followed by BPCL & HPCL with shares of 22% and 8% respectively.

In this chapter in addition to a description of the infrastructure at the aforementioned airports, information on Lucknow and Bhubaneshwar airports is also provided. The latter is included, in light of its proximity to the proposed KPC/IOC refinery in Orissa

The chapter aims to describe the facilities available at the airports including storage and fuelling, the companies operating at each of these airports, the sourcing of fuel as also jetfuel sales. Where available, information on airlines and flight frequency is also provided.

As the international airports are part of a complex which include the domestic airport, for these the international and domestic operations are presented together.

International airports

The major international operations in India occur at the airports at Delhi, Mumbai, Calcutta & Chennai.

Sales at the six international airports ('000 kl)

Airport	Total (International + Domestic)	International			
		Total	IOC	BPCL	HPCL
Delhi	806	606	312	252	42
Mumbai	675	509	220	188	101
Cochin	11.3	10.5	5.4	4.0	1.1
Thiruvananthapuram	52.0	49	37.1	11.9	N.A.
Chennai	174.1	90.5	72.6	5.6	12.4
Calcutta*	82.2	-	Of total Sales IOC : 73%, BPCL : 14%, HPCL : 13%		

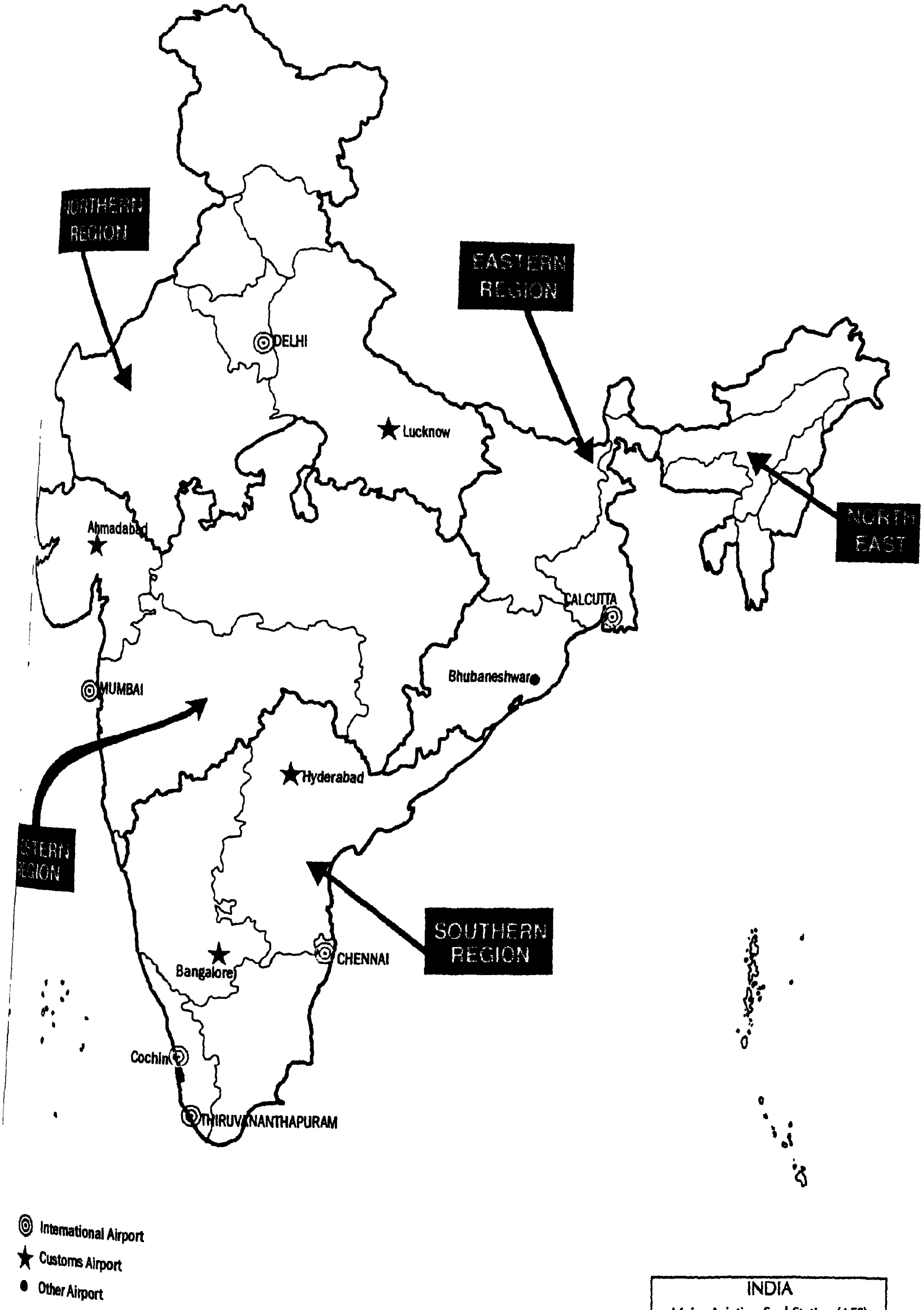
* The break-up of total sales is not available

1. Delhi: Indira Gandhi International Airport-Terminal 1 and Terminal 2

Terminal 2: International airport

This airport is managed by the Airport Authority of India. Its is located off the national highway between Delhi and Jaipur. The Airport Authority of India (AAI) had planned to construct 8 modules of the airport, of which only one module has been completed and is in operation. AAI plans to construct the second module near the international terminal to handle domestic traffic and close the old domestic airport. The plan is under consideration of Govt. of India. It will cost Rs. 2000-2500 million. With a view to handle increased trade, the export cargo complex has been expanded and provided with state of art facilities. A separate cargo complex with large cold storage capacity for export of fresh agricultural products is proposed to be built.

There is a plan to construct a third runway parallel to the existing main runway. AAI have commissioned a new Air Traffic Control Tower with modern communication and navigation aids at Delhi. Larsen and Toubro have been



INDIA

Major Aviation Fuel Station (AFS) Locations

Date : January 2000

Figure : 5.1

contracted to provide Category III Runway lighting system to tackle problems created by poor visibility due to thick fog in winter. It is expected to be ready by June 2000.

Jetfuel supply
The fuel is supplied from IOC's refinery at Mathura which is located at a distance of 160 km from Delhi to the installation at Bijwasan, via a pipeline. A pipeline owned by BPCL runs a distance of 4.5 km from the product terminal at Bijwasan in Delhi to supply the airfield station. The diameter of this pipeline is 8 inches and the capacity is 160 kl per hour. There are no supplies by rail or road. The emergency arrangements for fuel supply include tank wagons from the Koyali Refinery or from Kandla to BPCL's installation at Shakurbasti in Delhi and then by tank lorries from the Shakurbasti Installation.

Infrastructure for jetfuel
Indian Oil Corporation (IOC), Bharat Petroleum Corporation Ltd. (BPCL) and Hindustan Petroleum Corporation Ltd. (HPCL) operate at this airport. The storage facilities at this station include six above ground tanks. The total storage capacity is 42000 kl, share of IOC & BPCL being 24000 kl & 18000 kl respectively. The storage cover is for 23 days.

All fuelling companies draw their requirement from BPCL's owned and managed Aviation Service Station, which has hydrant facilities. There exist hospitality arrangements for the hydrant, which is shared by the 3 oil companies. Expenses on using the hydrant are settled by the Oil Coordination Committee. BPCL has laid pipelines, connected all the 27 bays at the apron with its pumping station. Of the total 27 bays, there are 9 passenger bays, 6 cargo bays and 12 remote bays. IOC dispenses at 11 bays, BPCL at 14 bays and HPCL at 4 bays.

The pumping station is computerised and BPCL has installed several automatic pumps which pump fuel at a very high speed.

In addition there are 3 refuellers, one each owned by the oil companies. The capacity of these is 45 kl each. The fuellers are used only for offloading fuel from the aircraft tanks due to technical reasons as and when required by the airlines.

Jetfuel sales
The airfield station operates through the day with three shifts, with each shift of eight hours duration. In 1998/99 the total sales were on the order of 606,000 kl (470 TMT). This was lower than the previous year primarily due to closure of

some airlines and curtailment and combining of flights. The sales made by each of the companies and their customer profile is provided below.

Sales at Indira Gandhi International Airport Terminal 2 at Delhi (000 kl)

	IOC	BPCL	HPCL	TOTAL
1996/1997	3,31 (257)	2,64 (2205)	44 (34)	6,39 (496)
1997/1998	3,48 (270)	2,70 (210)	45 (35)	6,63 (515)
1998/1999	3,12 (242)	2,52 (196)	42 (33)	6,06 (470)

Figures in brackets are in TMT

IOC & BPCL caters to over 20 international airlines, whereas HPCL makes sales to Air India, Indian Airlines and Aeroflot.

Terminal 1: Domestic airport

The domestic airport located at Palam (it was earlier called the Palam Airport), is also managed by AAI. It operates round the clock and can handle B 747/AN-124 aircrafts.

Jetfuel supply

This airport is fed by tank lorries from the installations of BPCL and HPCL at Shakurbasti. Shakurbasti is about 20 km from the domestic terminal and BPCL deploys 5 tank lorries with an aggregate capacity of 74 kl, and HPCL deploys 4 with a capacity of 72 kl. IOC gets its supplies via a pipeline from the Bijwasan terminal. The pipeline is of 8.5 km length and has a capacity of 40 kl/hour.

Emergency supplies can be sourced by IOC from its installation at Shakurbasti by tank lorries. BPCL on the other hand can source it from its service station at Terminal 2.

Jetfuel Infrastructure

There are 17 storage tanks with a capacity of 2750 kl. IOC's 7 tanks have a capacity of 1400 kl, HPCL's 7 tanks are of 900 kl capacity and BPCL's 3 tanks have a capacity of 450 kl.

This terminal is not equipped with a hydrant system. Instead, refuellers are deployed. IOC owns 16 refuellers and BPCL and HPCL have 7 and 4 respectively.

IOC can cater to 60 flights in a day, and the capacity of BPCL is 25 flights, and HPCL is 20 flights.

Jetfuel sales

In 1998/99 a total of 200 thousand kl were sold at the domestic airport, with the bulk of the sales made by IOC. IOC has recently augmented its market share (although marginally) due to allotment of long sector flights of private airlines to the company.

Sales at terminal 1: Delhi airport (000 kl)

	IOC	BPCL	HPCL	Total
1996/1997	1,38 (107)	32 (25)	21 (16)	191 (148)
1997/1998	1,39 (108)	33 (26)	22 (17)	194 (151)
1998/1999	1,44 (112)	32 (25)	24 (19)	200 (156)

Figures in brackets are in TMT

2. *Mumbai: Chhatrapati Shivaji International Airport (Sahar Airport) and Santacuz Domestic Airport*

Chhatrapati Shivaji International Airport

Mumbai Airport, call sign VT-BOM, is owned and managed by Airport Authorities of India.

The Airport is open for traffic round the year and works 24 hours a day. There are two runways, the main runway being 3491 metres long and the second being 2730 m. long. As the runways cross each other they are not used simultaneously for flight operations.

The International Terminal (Sahar Airport) and Domestic Terminal (Santacruz Airport) are situated apart from each other within the Airport premises. Distance between the 2 terminals from within the airport is approximately 2.5 km, where as that for public movement it is approximately 6 km.

As regards the International Terminal there is no further space for expansion after Module 2-C was commissioned recently. Therefore a new international airport is proposed at Revas-Mandva in Raigad district about 100 km away from Mumbai. However the proposal is meeting opposition from various fronts. The proposal has not taken any concrete shape to-date.

Jetfuel supply

Three companies are in operation to meet fuel requirements of the aircrafts operating through Mumbai Airport. These are IOC, BPCL and HPCL.

Product is received from BPCL and HPCL refineries marketing terminal at Mahul through a 19.97 km long 8" diameter, dedicated pipeline managed by

HPCL The pipeline is kept full with jetfuel at all times and holds a total of 683 kl. It is designed for a flow rate of 220 kl per hour.

The pipeline has three tapping points, one for IOC at Sahar, the international airport and two at Santacruz, the domestic airport, for IOC and BPCL and it terminates at the new HPCL Service Station at Santacruz.

In case of disruption in pipeline transfers from the refineries, product can be moved by road. Both the refineries have tank lorry loading facilities and each location at the airport has tank lorry unloading facility. Although there are no dedicated tank lorries retained for use in case of emergency, suitable tank lorries available in the market are acquired and pressed into jetfuel service after all quality control procedures are carried out. Such emergency has not arisen in the recent past.

Jetfuel infrastructure

The International Terminal Building consists of 3 modules 2A, 2B and 2C. Each module is assigned to a group of Airlines to facilitate handling of passengers resorting to their services. The apron at the International Terminal has 15 Contact Bays each equipped with an Aerobridge for movement of passengers. Also there are 12 Remote Bays. A total of 27 aircrafts can be parked on the apron at a time.

Cargo complex in the close vicinity of the international terminal building has 5 bays for parking of aircrafts carrying cargo. Warehouses are located opposite the parking bays.

The tankage and the hydrant system laid and managed by IOC at Sahar are used by all oil companies to undertake refuelling operations at the international terminal. The tankage facilities owned by IOC include four overhead tanks of 6000kl each, and a storage cover of 4 days is provided for.

The hydrant system connects all 27 bays at passenger terminal and 5 bays at the cargo complex. A 24" line running from IOC, Sahar is provided with 8" branch lines upto each bay where 4" hydrant point each at port and starboard side is made available for 2 point refuelling whenever required. A series of pumps are installed at IOC, Sahar, to maintain 110 psi line pressure at all times to ensure adequate flow rate even during multi-bay refuelling operations.

The entire hydrant system is for use by all companies. Therefore, no separate facilities have been developed by BPCL and HPCL at Sahar to service their customers.

IOC has two refuellers of 45 kl capacity each, located at the international terminal.

Although BPCL have a base Office at the international terminal their service station at Santacruz (the domestic airport) is the nodal point for controlling operations at both the terminals. The fleet of 11 dispensers is used exclusively for fuelling operations at the international terminal. They own seven refuellers.

HPCL have their base at the domestic airport from where all refuelling operations are controlled. Their fleet of 8 dispensers is also for use at the International Terminal. They have two refuellers of 45 kl capacity each.

Jetfuel sales

Air India is the single largest international flight operator, out of approximately 40 Airlines operating through Mumbai Airport. Air India operates a total of 110 originating and 107 terminating flights per week at Mumbai Airport. Whereas Air India business is shared by all the 3 oil companies (IOC:28%, BPCL:22%, HPCL:50%) supplies to other Airlines are made as per contract entered into with individual Airlines. Oil companies are free to canvass business.

Jetfuel Sales Mumbai Airport: International Airlines (000 kl)

	IOC	BPCL	HPCL	Total
1997/98	203 (158)	172 (133)	96 (75)	471 (366)
1998/99	220 (171)	188 (146)	101 (78)	509 (395)

Figures in brackets are in TMT

Air India operates 110 flights through Mumbai airport, of the total of 303 international flights flying from this airport in a week. Of the 193 flights being operated by international airlines, 15 are transit and 93 are direct flights to middle east, whereas 85 flights are to other destinations.

For international flights fuel upliftments are monitored on a large scale particularly for flights operating from/to Middle East where at some of the stations fuel rate is reported to be competitive. Details of rate at various stations in Middle East could not be obtained because concerned authorities preferred to maintain contractual secrecy. However it was understood from a reliable source that the rate at Abu Dhabi is USD 200 per kl (USD 257 per tonne). And with no sales tax applicable, the rate works out to about USD 71.00 per kl. cheaper than that in Mumbai.

The present pattern of flights which can resort to tankering of fuel and hence requiring smaller quantities is as under:

No. of flights:

		AI & IAC	Foreign Airlines	Total
1.	Return from M.E. direct	–	93	93
2.	Return to M.E. direct	31	4	35
3.	Flights from Middle East passing through Mumbai	–	6	6
4.	Foreign bound flights with one stopover in India	47	–	47
5.	Short distance flights	24	9	33
		102	112	214

ME: Middle East

The above flights form 76.4% of the total international flights (303). A large number of flights may resort to tankering resulting limited upliftment of fuel at Mumbai. With tankering from some of the locations in Middle East the terminating flights may have additional fuel on board restricting upliftment of fuel for subsequent flight.

Mumbai: Santacruz Airport, domestic terminal

There are 2 separate terminal buildings for domestic flight operations close to each other. Terminal 1A is used exclusively for flights operated by Indian Airlines and Alliance Air a subsidiary of IA. Terminal 1B is for the use by private air taxi operators. Currently only Jet Airways is in operation.

There are 7 Bays at Terminal 1A, 3 of which have an Aerobridge and a total of 18 Parking Bays at Terminal 1B .

The Airport Master Plan provides for augmentation of facilities at the domestic Terminal. Two new domestic terminal buildings and a cargo complex are envisaged in the Master Plan. The current Terminal 1-B is slated to give way to a new terminal building, with another planned to be erected between the present 1-A and the proposed one in place of 1-B.

Jetfuel supply source

As mentioned earlier jetfuel is sourced from the Mahul marketing terminal of the refineries of BPCL and HPCL, through a pipeline. BPCL and IOC have a tapping point each at the domestic airport, and the pipeline terminates at HPCL's service station at the domestic airport. In case of disruptions, the product can be moved by road in tank lorries.

Jetfuel infrastructure

The storage capacity at Santacruz includes 6 tanks each owned by IOC and BPCL and 7 owned by HPCL. These include 11 underground tanks.

IOC has tankage of 2000kl, BPCL 1200kl & HPCL 17,950 kl. Although the hydrant system has been laid by HPCL covering 3 Bays at Terminal 1-A, the same is not operational. Thus far all fuelling operations at the domestic terminal are carried out by refuellers.

IOC has 10 refuellers . In comparison BPCL owns 7 refuellers and HPCL has 2 refuellers.

IOC's service station at Santacruz is retained for tankage and parking of refuellers to be used at the domestic terminal. However, all its operations are controlled by the Sahar office. Operations of BPCL and HPCL at the domestic and international terminals, on the other hand are managed from Santa Cruz.

Jetfuel sales

In 1998/99, of the total sales made at the Mumbai airport, about 24% were for domestic operations.

Jetfuel sales: Domestic operations (000 kl)

	IOC	BPCL	HPCL	Total
1997/98	121 (94)	30 (23)	13 (10)	164 (127)
1998/99	109 (85)	41 (32)	16 (12)	166 (129)

Figures in brackets are in TMT

A total of 670 domestic flights are operated in a week from Santacuz airport, of which Indian Airlines operates 204, Alliance Air 75 and jet Airways 391.

The fuel business of the domestic operators is shared by the oil companies as under:

	Indian Airlines	Alliance	Jet Airways
IOC	60%*	70%	262 flights
BPCL	32%	30%	68 flights
HPCL	8%	-	61 flights

*Includes 9 International flights operated by Indian Airlines: 1 Return to Karachi and 6 to and from Sharjah via other Indian Airports.

The shareout of IAC business includes maintenance fuelling.

In the case of domestic flights there is not much of a scope for competition restricting upliftment of jetfuel at Mumbai. However in the case of flights to and from Delhi the operators may resort to monitor upliftment in order to avail advantage of lower sales tax applicable at Delhi (11.0%). This is of course, subject to observance of safe landing weight at Mumbai. Carriage of excess fuel from Delhi may not always be economical due to higher consumption of the extra fuel which forms dead weight.

3. Cochin

Cochin International Airport Ltd. is a joint sector project set up by the Kerala State Government with equity participation from the public. It was commissioned in May 1999. The other major stakeholder in this project is Bharat Petroleum Corporation Ltd.

It is located at Nedumbassery, 25 km north-east of Cochin. A runway of 11000 feet (3400 m), and night landing facilities are provided and the airport functions round the clock. In the second phase of the project, a second terminal building will be erected, and an apron to accommodate 12 aircrafts will be built. It is also proposed to extend the existing railway line to the airport complex to serve both cargo and passenger movements.

This airport is expected to handle 1.5 million passengers in the first year, which is expected to quadruple in 12 years.

Jetfuel source

Fuel is sourced from the Cochin refinery which is at a distance of 36 km from the airport. BPCL employs tank trucks to move the fuel by road.

Jetfuel infrastructure

BPCL has erected two above ground storage tanks of 2300 kl capacity each and two are underground with a capacity of 100 kl each. These provide a cover for 145 days. Product of all the 3 companies operating here, is stored in these tanks. BPCL's aviation fuelling station has a fleet of mobile units for refuelling from the hydrant, each capable of dispensing fuel at a speed of 3800 litres per minute. IOC has four dispensers and HPCL two. These cater to two bays for international movement, four for domestic and two for cargo.

IOC and BPCL each own two refuellers, whereas HPCL owns one. The maximum fuelling capacity is 10 per day.

Jetfuel sales

Since this airport in its present location was commissioned only a few months back in May 1999, sales data are provided for the period June-November 1999. Total sales of over 11,000 kl (9 MMT) were made in this period, of which about 10,000 kl were for international operations.

Sales at Cochin airport ('000 kl)

	IOC	BPCL	HPCL	Total
International	5.4 (4.2)	4.0 (3.1)	1.1 (0.9)	10.5 (8)
Domestic	0.3 (0.2)	0.5 (0.4)	.012 (.009)	0.8 (0.6)

Figures in brackets are in TMT

4. *Thiruvanthapuram*

The airport at Thiruvanthapuram is located at Vallakadavu port. It operates from 0600 hours to 2000 hours. It is an international airport and handles domestic flights too. The operations at this airport are not of the same scale as Delhi and Bombay.

It can handle all aircraft except Boeing 747. Future plans for this airport include refurbishing the terminal building, increasing the taxiway, and building a cargo complex. It is also proposed that the domestic terminal will be shifted to the opposite side of the present terminal.

Jetfuel supply

This airport receives supplies from the refinery at Cochin which is located at a distance of 240 km. Fuel is moved by tank lorries. IOC and BPCL operate at this airport and the companies own trucks with a capacity range of 12-20 kl.

Jetfuel infrastructure

The two above ground storage tanks owned by IOC have a total capacity of 1000 kl, whereas the 2 of BPCL have a total capacity of 500 kl.

At present there is no hydrant system in place, although there are plans to install it in the future.

IOC owns five refuellers, with a total capacity of 96 kl. BPCL has 3 refuellers. The maximum fuelling capacity at this airport is 18 flights per day.

Jetfuel sales

Sales to international airlines in 1998/99 were a little over 49,000 kl, with bulk of the sales (75%) made by IOC. The trend in sales over the last few years is provided below.

Sales to international airlines: Thiruvanthapuram airport (000 kl)

	IOC	BPCL	Total
1995/96	21.1(16.4)	6.6 (5.1)	27.7 (21.5)
1996/97	24.3(18.9)	7.6 (5.9)	31.9(24.8)
1997/98	38.6(30.0)	11.2 (8.7)	49.8 (38.7)
1998/99	37.1(28.8)	11.9 (9.2)	49.0 (38.0)

Figures in brackets are in TMT

The sales to domestic airlines at this airport were 3000 kl. The break-up of sales by company are provided below.

Sales to domestic airlines: Thiruvanthapuram airport ('000 kl)

	IOC	BPCL	Total
1995/96	0.8 (0.6)	1.2 (0.9)	2.0 (1.5)
1996/97	0.8 (0.6)	1.2 (0.9)	2.0 (1.5)
1997/98	1.9 (1.5)	1.2 (0.9)	3.1 (2.4)
1998/99	1.8 (1.4)	1.2 (0.9)	3.0 (2.3)

Figures in brackets are in TMT

The customer profile of IOC includes Gulf Air, Air Lanka, Kuwait Air, Singapore Airlines, in addition to AI, IA & Jet Airways. BPCL caters to AI, Jet airways and Qatar airways.

5. Chennai airport

The Chennai airport is located at Menambakkam, Pallavaram Cantonment. It is owned by the AAI and operates round the clock.

There are two runways now in operation of lengths 2036 meters & 3658 meters. At present, the extension of the first runway is in progress, and an additional length 300 meters is being constructed. At this airport two additional in-contact bays and two remote bays are under construction, to cater to the increasing air traffic.

One of the major constraints at this airport is the availability of land for any expansion activity to be taken up by any oil company. IOC has the best space efficiency, location and visibility. Besides IOC, BPCL and HPCL also operate at this airport.

There is a proposal to build a new international terminal building, and to construct another international airport at a place called Tambaram south of the present airport. The composition and proposed infrastructure facilities of the latter are not yet clearly defined.

Jetfuel supply

All 3 oil companies source the fuel from the terminal at Tondiarpet in Chennai which is about 28 km from the airport. Jetfuel is moved by tank trucks with a capacity varying from 1 kl, 18 kl and 20 kl. The emergency sourcing of the fuel can be undertaken directly from the Madras refinery located at Chennai.

Jetfuel infrastructure

There are 10 storage tanks, of which 7 are located above ground and have a capacity of 3092 kl. The underground tanks have storage capacity of 45 kl. The storage cover ranges from 23 days for BPCL, 6 days for IOCL and 6 days for HPCL. IOC and BPCL operate round the clock, whereas the operations of HPCL are limited to two shifts in a day, with a provision for a night shift on two days of the week.

This airport does not possess a hydrant system. IOC and BPCL have submitted proposals for the same.

The 3 companies together have a fleet of 19 refuellers, with IOC owning 11 and the other two owning 4 each.

Jetfuel sales

About 90 thousand kl of jetfuel was sold to airlines with international operations through the Chennai airport. This category of sales has increased by 8% per annum over the last three year period.

Sales to international airlines: Chennai Airport (000 kl)

	IOC	BPCL	HPCL	Total
1995/96	62.8 (48.7)	1.6 (1.2)	6.9 (5.3)	71.3 (55.3)
1996/97	73.0 (56.7)	2.0 (1.6)	10.5 (8.1)	85.5 (66.4)
1997/98	73.0 (56.7)	4.5 (3.5)	10.5 (8.1)	88.0 (68.3)
1998/99	72.6 56.4)	5.6 (4.3)	12.4 (9.6)	90.5 (70.2)

Bulk of the sales made to domestic carriers are by IOC. The total sales to this segment is about 83 thousand kl, and has grown at a robust rate of 8% over the last few years.

Sales to domestic airlines: Chennai airport (000 kl)

	IOC	BPCL	HPCL	Total
1995/96	58.0 (45.0)	0.8 (0.6)	6.4 (5.0)	65.2 (50.6)
1996/97	66.3 (51.5)	2.1 (1.6)	7.0 (5.4)	75.4 (58.5)
1997/98	67.4 (52.3)	4.0 (3.1)	9.4 (7.3)	80.8 (62.7)
1998/99	67.0 (52.0)	5.2 (4.6)	11.4 (8.8)	83.6 (64.9)

The share of the three companies in total sales is as follows: BPCL: 7%, HPCL: 17.% & IOCL: 76%. The details of sales made to each airline, however, are not available.

The major airlines operating through this airport include Singapore Airlines, Malaysian Airlines, Gulf Air, Saudia, Oman Air, Air Lanka, Air India British Airways, Lufthansa, Al Italia, Air France , Swiss Air.
Domestic operations of Indian Airlines, Jet Airways, Alliance Air and Sahara are also undertaken here.

6. Calcutta airport

This airport is named Netaji Subhash Chandra Bose International Airport. It is located at Dum Dum, which is 20 km from the city. There are two terminal buildings, the international and a new domestic one. The latter became operational in January 1995. In 1998/99, this airport handled 8% of the international aircraft movements from India. Its share in domestic aircraft movements was higher at 12%. The average traffic movement in a day comprises 18 aircrafts for international movement and 48 for domestic. Also, on the average, it handles about 1600 international passengers and 5200 domestic passengers.

This airport works round the clock and the largest aircraft it can handle is B 747/Concorde.

The Airport Authority of India is planning an integrated cargo complex at this airport, as also an additional hangar. Further, there are plans to modify the international terminal.

Jetfuel source

IOC, BPCL and HPCL operate at this airport and all three source the fuel from the Mourigram tap off point (TOP) on the Haldia-Raybandh pipeline, located at a distance of 35 km from the airport. IOC has a fleet of 18 tank lorries, each with a capacity of 20 kl, whereas the fleet deployed by BPCL comprises 5 tank-lorries with a capacity of 12 kl each, and HPCL deploys 4 with a capacity of 12 kl each.

Jetfuel infrastructure

At the Calcutta airport fuel is stored in 8 above-ground storage tanks, with a total capacity of 5950 kl. IOC has a storage of 4950 kl, which provides 30 days cover and BPCL & HPCL have storage of 500 kl each, with 15 days cover each. Regarding fuelling operations, a hydrant system is under construction, and is expected to be completed in six months. In the meantime, there are 19 refuellers in operation, 12 of which are owned by IOC.

Jetfuel sales

The total sales in 1998/99 is over 82,000 kl (64 TMT). In 1997/98 the sales had dropped due to imposition of a surcharge of 15% over the sales tax of 25%.

Jetfuel sales at Calcutta airport (000 kl)

	IOC	BPCL	HPCL	Total
1996/97	60.4 (47)	13.7 (10.6)	8.0 (6.2)	82.1 (63.7)
1997/98	55.0 (43)	8.0 (6.2)	9.4 (7.3)	72.4 (56.2)
1998/99	60.0 (46)	11.5 (8.9)	10.7 (8.3)	82.2 (63.8)

Figures in brackets are in TMT

Domestic airports

Major domestic operations take place at the designated international airports, as is evident in the previous section. In addition, there are some major domestic airports for which details are provided below:

Sales to domestic carriers at major airports

Airport	Sales in 98/99 ('000 kl)	IOC	BPCL	HPCL
International				
Delhi	200	144	32	24
Mumbai	166	109	41	16
Cochin	0.8	0.3	0.5	Neg.
Thiruvananthapuram	3.0	1.8	1.2	N.A.
Chennai	83.5	67.0	5.2	11.4
Domestic				
Lucknow*	9.6	9.6	N.A.	N.A.
Ahmedabad*	24.5	19.8	4.7	N.A.
Bangalore	71.6 (15.7 for intnl.)	56.7 (12.4 for intml.)	14.9 (3.3 for intml.)	N.A.
Hyderabad	33.3 (10.3 for intnl.)	28.6 (8 for intml.)	4.7 (2.3 for intml.)	N.A.
Bhubaneshwar**	8.1	7	1.1	N.A.

Note: For Calcutta, total jetfuel sales are known. Separate estimates for domestic & international operations, and by company are not available.

NA: Not applicable

* Sales made for the limited international operations are not available

** It is not a major airport but has been included as it is near the proposed IOC/KPC refinery.

1. Lucknow airport

The Civil Aerodrome at Lucknow is owned by AAI. It is located at Amansi, which is 10 kms away from city. It is a domestic airport although it is handling limited international flights(Delhi-Amritsar/Sharjah via Lucknow). The existing terminal building is adequate to handle only 750 passengers at peak hours.

The Government has not yet declared it as an international airport. It can handle AB-320/A-300 aircrafts. AAI plans to extend the existing runway to 9000 feet and install category II instrument landing system and approach lighting system (for which the Government has been requested to acquire 83 acres of land and hand over to AAI free of cost). It is also planning to construct an additional new terminal complex to cater to 1500 passengers. A new technical block and a cargo complex are also envisaged.

Jetfuel source

Jetfuel for sale at this airport is sourced from the terminal at Kanpur, which is 85 km from the airport. The terminal in Kanpur sources the product from IOC's refinery at Barauni.

The product is moved by 3 tank trucks, each of a capacity of 18 kl.

Jetfuel infrastructure

This airport has four storage tanks of 200 kl capacity each. There are 2 tanks overground 2 are semi- underground. The storage cover is for 30 days.

There is no hydrant system at this airport. However there are four refuellers. The storage and fuelling facilities belong to IOC, which is the sole operating company here.

Jetfuel sales

In 1998/99 the sales recorded at this airport was 9,600 kl (7.4 TMT). The increase in sales is due to induction of additional flights including the international flight to Sharjah via this airport.

Sales at Lucknow airport ('000 kl)

1996/1997	9.1 (7.1)
1997/1998	9.2 (7.1)
1998/1999	9.6 (7:5)

Figures in brackets are in TMT

The airlines taking supplies include Indian Airlines, Jet Airways, Sahara Airlines and the Lucknow Flying Club.

2. Ahmedabad airport

Ahmedabad Airport, named Sardar Vallabhbhai Patel International Airport is owned and managed by AAI.

The airport is open for traffic during all seasons and works round the clock. Currently, however, the airport is closed for flight operations between 0900 hrs and 1700 hrs due to runway extension work. The 2743 meter long runway is being extended to 3504 meters. The extension work is expected to be completed within the next 6 months.

The airport has 2 terminal buildings for handling domestic and international passengers separately. A new international terminal building is planned. Although construction work has not commenced so far, the building is expected to be ready within an year.

There are 5 parking bays and 3 more are being laid. Completion is expected within 6 months. 2 out of the 3 bays will be contact bays for the proposed international terminal building and will have aerobridges.

Flights of B747 are planned to be operated at the airport, on completion of the runway extension and additional bay laying work. Presently the largest aircraft operated through Ahmedabad airport is AB 300.

The space available within the airport is large enough to cater to growing traffic by providing additional facilities if necessary. As such there are no plans to resite the Airport.

Jetfuel source

Jetfuel stocks are received by road in dedicated epicoat lined tank lorries from Sabarmati Terminal owned and managed by IOC, which gets the fuel from IOC's refinery at Koyali.

Jetfuel infrastructure

The total storage available is 1110 kl, 610 kl of which is that of IOC. All refuelling operations are carried out by means of refuellers. Present strength of refuellers at Ahmedabad airport is 7, 4 of which belong to IOC.

Jetfuel sales

The total sales at this "customs" airport were 24 thousand kl (18.6 TMT).

Sales at Ahmedabad airport ('000 kl)

	IOC	BPCL	Total
1996/97	18.5 (14.4)	4.7 (3.6)	23.2 (18.0)
1997/98	22.0 (17.1)	5.2 (4.0)	27.2 (21.1)
1998/99	19.8 (15.4)	4.7 (3.6)	24.5 (19.0)

Figures in brackets are in TMT

The above sales include small deliveries to any incoming Indian Air Force (IAF) and non-scheduled flights. 81 flights in a week are for domestic destinations through this airport and international flights are 22 in a week.
Whereas all IAF aircrafts are refuelled by IOC, services to non-scheduled flights are rendered as per arrangements made by the operators.

With augmentation of facilities at the airport more flights are expected to be operated. However fuel upliftment is not likely to increase appreciably due to:

1) high rate of taxation prevalent in the State of Gujarat
2) introduction of fuel efficient aircrafts and flying time to and from Ahmedabad Airport connecting other stations is 1 to 1 ½ hours, implying that operators prefer minimum or nil upliftment at Ahmedabad Airport.
3) high fuel consuming B 737 aircraft currently operated by Alliance will be gradually phased out and replaced by fuel-efficient aircrafts.
4) B 747 aircraft when introduced will replace A 300 and AB 4 aircrafts currently being operated by Air India as domestic extension flights. This will eliminate aircraft change at Mumbai and Delhi. The aircraft is not likely to carry enough load, to prevent tankering of fuel from an economic location.

With limited sale volumes no scope exists for introduction of additional vendor although there is enough space available for developing further facilities.

3. Bangalore airport

The Bangalore Airport is a "customs" airport. It is owned by Hindustan Aeronautics Limited (HAL) and is located at Vimanapura, Bangalore. It operates round the clock. It is primarily a domestic airport with some international operations. It can handle boeing – 747 – 400 series.

In 1992/1993 a proposal was mooted to establish a new airport to cater to the needs of the ever growing traffic needs of Bangalore. The Civil Aviation Ministry identified the location at Devanhalli, a satellite town at a distance of 40 km north of Bangalore. The Tata group had evinced interest in the project, but after prolonged discussions and deliberations the Tata's withdrew their offer. Several factors that seem to have influenced the decision, a major one is seen to be the fact that the Ministry was undecided about the viability of the Airport operation itself, as only international flights were to be operated from the new airport. It is also understood that though HAL has seven different units under its aegis, the units which are profit making are only the Engine Overhaul Division and the Airport operations. HAL is reluctant to surrender this activity either partially or in toto.

In view of the political sensitivity, apparent importance for the proposal to have a new airport and also the fact that other infrastructure providers, the hotel industry, the transport industry etc., have a strong lobby, the proposal is being re-opened.

It is understood that agencies who are being considered are Reliance/Changi airport, Brinken Hope, Seimens and Zurich airport authority, L&T with Stefal airport, Bechtel with Dubai airport and ABB.

Jetfuel source

Jetfuel is moved by tank lorries from the installation of IOC at Devangunthi (39 km) and that of BPCL at Tondiarpet (360 km).

Jetfuel infrastructure

There are six above ground storage tanks, three each belonging to IOC and BPCL, with a total capacity of 2550 kl. IOC also has a 70 kl capacity underground storage for aviation gas. These provide a cover for 8 days.
IOC operates round the clock, whereas BPCL operates two shifts only. There is a provision for night shifts on two days of the week.

At present this airport does not possess a hydrant system. IOC and BPCL own 9 and 4 refuellers respectively.

Jetfuel sales

Sales for domestic operations: Bangalore Airport (000 kl)

	IOC	BPCL	Total
1995/96	54.8 (42.5)	14.3 (11.1)	69.1 (53.6)
1996/97	57.1 (44.3)	13.4 (10.4)	70.5 (54.7)
1997/98	58.3 (45.2)	14.8 (11.5)	73.1 (56.7)
1998/99	56.7 (44.0)	14.9 (11.6)	71.6 (55.6)

Figures in brackets are in TMT

Sales for international operations: Bangalore Airport (000 kl)

	IOC	BPCL	Total
1995/96	1.2 (0.9)	2.3 (1.8)	3.5 (2.7)
1996/97	12.5 (9.7)	2.9 (2.2)	15.4 (11.9)
1997/98	13.0 (10.1)	2.8 (2.2)	15.8 (12.3)
1998/99	12.4 (9.6)	3.3 (2.6)	15.7 (12.2)

Figures in brackets are in TMT

Domestic sales account for 82% of the total sales at the Bangalore airport.

4. Hyderabad airport

The airport is located at Begumpet, Hyderabad. It is a domestic airport with some international operations, and qualifies as a "customs" airport. It can handle A-300. Tristar with load restrictions and Boeing 747 with severe load restrictions.

AAI is planning to extend the existing runway length from 9000 feet to 12000 feet, so that bigger aircrafts like Tristar and Boeing 747 can be easily accommodated by the year 2001-2002. But the citizens committee of Secunderabad and other NGO's have strongly protested this expansion. A public interest litigation (PIL) is in the offing.

A new international airport is being planned at Samshabad about 30 kms from Hyderabad. An area of 5000 acres of land has been notified by the State Government and the acquisition process is on. Tata Consultancy Services has been awarded the contract for the preparation of Detailed Project Report (DPR), which is expected to be ready by February/March 2000. Once the DPR is ready, the State will begin necessary activity for tendering (global) and further process will be on.

It is expected that the new Airport will be ready by the year 2004-05, especially in light of the interest evinced by the Chief Minister and the encouragement given by NRI's and the others. A decision is yet to be taken whether only international operations will be shifted, in view of the economic viability of operations.

Jetfuel source

The fuel is sourced from the terminal at Tondiarpet, in Chennai, which is about 700 km from the airport. Fuel is moved in tank lorries of size ranging from 12 kl to 20kl.

Jetfuel infrastructure

The two oil companies in operation at the airport are IOC and BPCL, which have 5 above ground tanks with a total storage capacity of 3380 kl. IOC's 3 tanks store 1680 kl and provide 15 days cover.

There is no hydrant system at the airport. IOC owns 6 refuellers and BPCL has 3 refuellers. IOC has round the clock operations whereas BPCL works two shifts in a day.

Jetfuel sales

Total sales of 43000 kl were made last year, bulk of which were for domestic operations, as is evident below.

Jetfuel sales for domestic operations: Hyderabad airport (000 kl)

	IOC	BPCL	Total
1995/96	29.4 (22.8)	3.6 (2.8)	33.0 (25.6)
1996/97	27.7 (21.5)	3.8 (2.9)	31.5 (24/4)
1997/98	26.8 (20.8)	3.7 (2.9)	30.5 (23.7)
1998/99	28.6 (22.2)	4.7 (3.6)	33.3 (25.8)

Figures in brackets are in TMT

Jetfuel sales for international operations: Hyderabad Airport (000 kl)

	IOC	BPCL	Total
1995/96	3.1 (2.4)	1.1 (0.8)	4.2 (3.2)
1996/97	4.9 (3.8)	1.3 (1.0)	6.2 (4.8)
1997/98	6.4 (5.0)	1.6 (1.2)	8.0 (6.2)
1998/99	8.0 (6.2)	2.3 (1.8)	10.3 (8.0)

Figures in brackets are in TMT

5. Bhubaneshwar airport

The Bhubaneshwar airport, was rechristened Biju Patnaik Airport in 1998. It is located on National Highway 5 and is managed by AAI.

This airport is built in an area of 6264 square metres. The new terminal building can handle 500 passengers at a time.

The AAI plans to extend the existing runway from 7500 feet to 9000 feet to enable operations of bigger aircrafts.

Jetfuel source

Fuel is sourced from the refinery at Haldia (in West Bengal), which is at a distance of 500 km from the airport. A fleet of 5 tank lorries moves the fuel by road.

Jetfuel infrastructure

The four above ground storage tanks at this airport have a total capacity of 800 kl. IOC owns 2 tanks with a capacity of 200 and 100 kl each. IOC has a tankage cover of 15 days, and BPCL's cover is for 30 days.

The airport works from 0600-2200 hours.

There are four passenger bays. IOC owns 3 refuellers whereas BPCL has 2 refuellers.

The major airlines at this airport are Indian Airlines, Alliance Air, and Mescco Airlines.

Jetfuel sales

Jetfuel sales: Bhubaneshwar Airport (000 kl)

	IOC	BPCL	Total
1996/97	8 (6.2)	-	8 (6.2)
1997/98	8.5 (6.6)	-	8.5 (6.6)
1998/99	7 (5.4)	1.1 (0.8)	8.1 (6.2)

Figures in brackets are in TMT

Comparative assessment

A comparative assessment of the six international airports in India is presented below to highlight the difference in the scale of operations at these. A similar assessment is provided for select domestic airports. The airports at Delhi & Mumbai account for 86% of the total sales made at the six international airports.

Comparison of the six international airports

	Fuel source	Storage	Hydrant System	Refuellers	Jetfuel sales (1998/99)	Any other
Delhi International (Terminal 2) Indira Gandhi Intl.Airport	Bijwasan installation, by pipeline of 4.5 km	6 tanks, 42000 kl capacity with 23 days cover	Yes, owned by BPCL Caters to 27 bays	3 refuellers, for offloading fuel only	606, 000 kl for international	
Domestic (Terminal 1) Palam Airport	Bijwasan installation, by pipeline of 8.5 km and Shakurbasti installation, by road, 20 km	17 tanks of 2750 kl capacity, with a total 9 day cover (3 for each oil company)	Nil	27 refuellers	200,000 kl for domestic	
Mumbai International (Chattrapati Shivaji, erstwhile Sahar)	BPCL and HPCL refineries at Mahul, by pipeline, 20 km	24000 kl	Hydrant system laid by IOC connects 27 passenger and 5 cargo bays.	2 refuellers of IOC	509,000 kl for international	Main runway is 3491 m long, and the second is 2730 m.
Domestic (Santa Cruz Airport)	BPCL and HPCL refineries at Mahul, by pipeline, 20 km	21150 kl, total cover of 38 days	Nil	10 of IOC, 7 of BPCL, 2 of HPCL	166,000 kl	New international airport proposed at Revas-Mandva, 100 km from Mumbai
Cochin	Cochin refinery, by trucks, 36 km	2 above ground tanks of 2300 kl each, 2 underground of 100 kl each, cover 145 days	Yes, 9 dispensers	5 refuellers	10,497kl international 826 kl, domestic	First Joint sector project, Phase 2 envisages expansion and new cargo complex.
Thiruvanthapuram	Cochin refinery, by road, 240 km	4 above ground tanks, of 1500 kl capacity, and 2 underground of 200 kl capacity; cover of 32 days	Nil	8 refuellers, 5 of IOC, 3 of BPCL	49,002 kl to international 3000 kl to domestic	Proposals to install hydrant, increase the taxiway, build a cargo complex
Chennai	Tondiarpet Terminal at Chennai, by road, 28 km	12 tanks, 9 above ground with capacity 3492 kl, 3	Nil	19 refuellers, of which 11 of IOC	90,514 kl sold for international, of which 72,564	Proposal to build another international airport at

	Fuel source	Storage	Hydrant System	Refuellers	Jetfuel sales (1998/99)	Any other
		underground with 45 kl av gas capacity			by IOC 83,553 kl sold for domestic, of which 66,983 by IOC	Tambram, south of the present airport; also a new international terminal building planned
Calcutta (Netaji Subhash Chandra Airport)	Source: Morrigram installation, by road, 35 km	8 above ground tanks of 5950 kl capacity, total cover 60 days	Under construction, will be deployed in 6 months	19 refuellers, of which 12 of IOC; IOC can service 30 flights in a day	82,200 kl sold for domestic and international operations	

Comparison of the five select domestic airports

	Fuel source	Storage	Hydrant System	Refuellers	Jetfuel sales (1998/99)	Any other
Lucknow	Kanpur terminal, by road, 85 km	2 overground, 2 semi-underground, with total capacity 800 kl, 30 days cover	Nil	4 refuellers, 2 of 16 kl, one each of 9 kl and 6 kl capacity	9600 kl	A new terminal complex planned to cater to 1500 passengers, extension of runway to 9000 feet
Ahmedabad (Sardar Vallabhai Patel Air Port)	From Sabarmati terminal, by road Alternative supplies from oyali refinery, BPCL's installation at Kandla	7 tanks of 1110 kl capacity, 4 above ground and 3 underground, total cover 6 days	Nil	7 refuellers, 4 of IOC	24,532 kl sold to domestic and international carriers	2 terminal buildings. A new international building is planned
Bangalore	Fuel sourced from Tondiarpet installation at Chennai, by road, 360 km, and from Devangunthi installation, by road, 29 km	6 above ground tanks, capacity 1950 kl 1 underground of 70 kl cap for av gas	Nil	9 of IOC, 4 of BPCL	15,719 kl to international 71,613 kl to domestic	Proposal to establish a new airport—agencies being considered are Reliance/Changi airport, Bimken Hope/Siemens/Zurich APT, L&T /Stefal, Bechtel/Dubai APT, ABB
Hyderabad	Tondiarpet installation at Chennai, by road, 700 km	5 above ground tanks of 3380 kl capacity	Nil	9 refuellers, 6 of IOC	10,323 kl : International 33,301 kl: Domestic	New international airport planned at Samshabad, 30 km from Hyderabad. It is proposed to have equity of the State Govt, Non-resident Indians and others
Bhubaneshwar	Haldia Refinery, by road, 500 km	4 tanks, above ground, total capacity 800 kl, 45 days cover	Nil	5 refuellers	8100 kl	Plans to extend runway to accommodate bigger aircrafts

6

Jetfuel pricing

6.1 Historical background

The government appointed the first committee to recommend the basis for selling prices of petroleum products in 1968. This was followed by periodic review of the pricing system by subsequent pricing committees constituted by the government. Jetfuel was included in the list of bulk products considered for price control.

As a result of the above reviews, the 'Retention Price' concept for products produced at each refinery was introduced in July, 1975.

6.2 Ex-refinery jetfuel price based on retention prices for refineries

From July 1975, the jetfuel ex-refinery price was determined on the basis of weighted average retention price of jetfuel for various refineries in India.

The Oil Prices Committee (OPC) first worked out product-wise retention prices for each refinery by taking into account cost of crude, refinery processing costs and return on net worth at 12% after tax. Each refinery product was then indexed in relation to Kerosene which had an index of 1.00 to calculate product-wise retention prices. Annexure 6.1 shows how the retention price for jetfuel was arrived at by OPC in the case of one refinery.

The ex-refinery rate for jetfuel was finally arrived at by taking the weighted average jetfuel retention prices of the various refineries. The ex-refinery rate was thus uniform all over the country.

When a marketing company purchased jetfuel from a refinery, it paid the ex-refinery rate as fixed by OPC. The difference between the ex-refinery rate and the jetfuel retention price of the particular refinery was surrendered or recovered from the relevant Pool Account by the refinery.

The ex-refinery rate has since been replaced with Tariff Adjusted Import Parity Price of jetfuel, as described under Section 6.4.

6.3 Basic selling price of jetfuel at primary selling points under the administered pricing mechanism (APM)

As an example the basic selling price of jetfuel applicable to sales other than international airlines effective 3rd July, 1996 was computed as shown in the following Table 6.1. This selling price was uniformly applicable to all primary pricing points i.e. refineries:

Table 6.1 Basic jetfuel selling price at primary pricing points w.e.f. 3rd July 1996 (Rs.per kl)
(Excluding sales to international airlines)

Ex-refinery price	2260.15	
Marketing margin	128.62	
FSP surcharge	40.00	
C & F surcharge	640.00	
Total build up	3068.77	
Product price adjustment (PPA)	7768.79	
Ex-storage point price (Excluding Excise Duty)	10837.56	
Airfield (AFS) charge	171.68	
PPA for AFS charge	- 147.24	
Ex-storage point basic price applicable to International Airfields (Airports)	10862.00	(at refinery locations having local International Airports)
Surcharge for other Airfields	17.50	
Ex-storage point basic price applicable to other Airfields (Airports)	10879.50	(at refinery locations having other than International Airports locally)

The charges incorporated in the above price computation are briefly described below:

Marketing margin

It comprises fixed and variable marketing expenses under the three heads Installation, Distribution and Administration and includes Marketing Profit at the rate of 12% after tax on networth and 15% on borrowed capital.

The marketing margin was worked out by OPC separately for the three public sector companies marketing jetfuel and the weighted average is reflected in the price computation. The difference between the marketing margin accruing to each company and the quantum incorporated in basic selling price make-up is surrendered or recovered from the relevant pool account by the respective companies.

Pool accounts and levy of surcharges

The pool account mechanism has been in practice in the petroleum industry for quite some time and successive oil prices committees have been recommending the addition of new pool accounts to balance out variations between the recommended uniform prices and actual cost/retention prices, without resorting to frequent changes in the ultimate selling prices.

The primary objectives of the pool account adjustments are as under:

a) to maintain uniform prices in the markets irrespective of the supply sources;
b) to enable the refining and marketing companies to claim the retention margins automatically without getting their working capital locked up; (refining sector stands deregulated effective 1st April 1998)
c) to compensate the marketing companies for additional expenses incurred on importing products, the prices of which are governed by international market conditions and which eventually have to be sold under administered prices; and
d) to even out imbalances caused by non-refundable levies like octroi, irrecoverable sales tax and turnover tax on sales, etc.

While the pool accounts are generally expected to be self balancing, it becomes necessary to levy surcharges to ensure sufficient credit in the pool accounts so as to meet the claims of the marketing companies. Administration of pool accounts is one of the primary functions of OCC.

While deregulation of refining sector has reduced the need for pool accounts for that sector, a number of pool accounts are still in operation for the marketing sector. PSUs avail of the pool accounts governing administered products for a number of purposes. Cost & Freight Adjustment Account (with attendant C&F Surcharge), Freight Surcharge Pool Account (FSP) and Product Price Adjustment Account (PPA) are the main pool accounts connected with jetfuel sales.

&F adjustment account

Due to increase/decrease in the cost of any element included in the jetfuel retention price, variations arise between the cost and amount of that element included in the retention price. Such variations may relate to ocean freight, inland freight, insurance, exchange rate variation, cost of imported product, etc. Subject to certain norms and guidelines approved by the Government, such variations are adjusted through the C&F Adjustment Account. A C&F Surcharge is levied to enable the adjustments to be made.

Freight surcharge pool account (FSP)

With the establishment of primary pricing points in the country, the government felt the need to optimise the movement of petroleum products from one pricing area and avoid cross haulage of products. Consequently, FSP surcharge pool was introduced which permitted the marketing companies to seek reimbursement from FSP pool account for any additional cost incurred in the movement of products from one pricing area to another, subject to authorisation by the government. The government introduced an FSP surcharge incidence of Rs.40 per MT in basic selling price of each bulk product to meet the above claims. Adjustments in FSP for various movements would include:

a) Coastal movement of jetfuel through tankers.
b) Out of supply zone movements by road and rail

Product price adjustment account (PPA)

The price build up of each product as per OPC formula has not been strictly observed in practice by the government. There are price variations within the same product depending upon the end use and type of customers, e.g. the prices of kerosene and LPG are highly subsidised for domestic use whereas surcharges are levied for non-domestic use.

There are also cross subsidies between products i.e. subsidies on kerosene & LPG are offset by surcharges on Motor Spirit and jetfuel. As a result, whereas PPA accounts for kerosene and LPG are in big deficit, these are kept in balance to the extent possible by large surpluses in PPA accounts of Motor Spirit and jetfuel (for sales to domestic airlines).

Through the operation of this account, the Government is able to fulfil its socio-economic responsibilities towards society.

Airfield station (same as AFS) charge

This charge covers operating costs and return on capital employed in the facilities at the AFS. For AFSs situated at jetfuel storage locations, local transport cost from the storage to the AFS through a local pipeline or by road tank-trucks in built into the AFS charge. Separate AFS charge is worked out for each company and the weighted average of the respective charges for the three marketing companies is taken as the common AFS charge for the purpose of jetfuel pricing. Individual marketing companies either surrender or claim the difference between the common AFS charge and the respective AFS charge fixed for each of them from the AFS charge pool account.

Although companywise AFS charges are periodically reviewed and increased to take into account the higher operating costs, such increases have not been fully reflected over the years in the common AFS charge considered for jetfuel pricing. The unrecovered element is separately shown in the jetfuel price build-up as a negative PPA on AFS charge account for which reimbursement is claimed by the marketing companies from the PPA pool account.

6.4 Tariff adjusted import parity price (TAIPP) of jetfuel

After deregulation of refining sector effective 1st April 1998, the practice of establishing product-wise ex-refinery prices as weighted average of retention prices of various refineries was dispensed with. Also, prices of only five products, viz. Motor Spirit, High Speed Diesel Oil, Kerosene (for public distribution scheme), LPG (for domestic sales) and jetfuel are controlled from the above date. The marketing companies now determine the selling prices of other decontrolled bulk products themselves on the basis of import parity.

Effective 1st April 1998, erstwhile ex-refinery prices of the five controlled products including jetfuel sales, have been replaced with Tariff Adjusted Import Parity Prices which are worked out by OCC every month based on landed cost, viz. c.i.f. price, ocean loss, landing charges, customs duty and countervailing duty. The monthly TAIPPs form the basis on which payments are made to all refineries, including joint venture and private sector refineries, by the marketing companies for their upliftments of controlled products. No change in the retail selling rates is however made by the companies on the strength of monthly revisions in TAIPPs and any such change requires specific government approval. OCC also work out ex-refinery gate prices of public sector, joint sector and private sector refineries every month and inform the refineries of the prices fixed in each case. The precise methods of calculation of the TAIPPs and the ex-refinery prices by OCC are not known and therefore lack transparency. Reportedly the ex-refinery gate prices, inter-alia, take into account the respective crude costs of each refinery on the basis of the type of crude mix it refined, viz. totally indigenous or imported or partly both. The companies make adjustments with OCC to settle the difference between TAIPPs and their respective ex-refinery gate prices.

Table 6.2 shows the build up of ex-storage point price for sales of jetfuel based on TAIPP of jetfuel for the months of June and December, 1999 and January, 2000. It also shows ex-Airfield (Airport) basic selling prices.

Table 6.2 Basic selling price of jetfuel to domestic airlines at primary selling points under the Administered Pricing Mechanism (APM) post deregulation of refineries effective 1-4-1998 (for the months of June, and December 1999 & January 2000)

(Rs. per kl)

	June 1999	December 1999	January 2000
Tariff Adjusted Import Parity Price	7118.76	9398.24	10294.93
Marketing Margin	178.12	178.12	178.12
C & F Surcharge	1120.00	781.00	781.00
FSP Surcharge	256.00	302.00	302.00
Product Price Adjustment (PPA)	2086.44	99.96	- 796.70
Ex-storage point price (excluding excise duty)	10759.32	10759.32	10759.32
AFS charge	254.73	254.73	254.73
PPA for AFS charge	- 230.29	- 230.29	- 230.29
Ex-International Airfield (Airport) basic Price	*10783.76	*10783.76	*10783.76
Surcharge for other Airfields	17.50	17.50	17.50
Ex-other Airfield (Airport) basic Price	#10801.26	#10801.26	#10801.26

The ex-storage point price remained unchanged despite steep increase in TAIPP due to spurt in f.o.b. prices of jetfuel in December, 1999 and January, 2000. No change has been made in the jetfuel selling price for sales to domestic airlines due to absence of any such decision by the government. The increase in TAIPP has been adjusted in the PPA. Due to TAIPP reflecting the landed cost on import parity basis, the PPA has become a substantially negative figure in January, 2000 unlike the position shown in Table 6.1 under the retention price system where PPA was a high positive amount yielding overrecoveries to provide credit for the pool accounts.

A different basis is used for arriving at the selling price for international airlines which is set out in Section 6.6.

6.5 Jetfuel transport costs from primary pricing points i.e. refineries to other storage locations and from refineries/other storage locations direct to distant AFSs

For the purpose of pricing, jetfuel transport costs from primary pricing points i.e. refineries to other storage locations by various modes of transport and from refineries/other storage locations direct to AFSs by road are taken into account in the following manner:

a) Jetfuel movement by rail tankwagons:

Notional rail freight from the nearest jetfuel producing refinery to the storage location is considered, even if actual rail movement taken place from a different refinery. For example Shakurbasti (Delhi's inland installation) receives jetfuel supplies from Koyali refinery but the rail freight included in the price ex-Shakurbasti storage is from Mathura refinery which is nearest to Shakurbasti.

The shunting charges paid to Railways at the despatching refinery and siding charges recovered by Railways at the destination station are included in the price build-up.

The difference between the rail freight accounted for in the selling price and the higher rail freight actually incurred is claimed by the marketing companies from FSP pool account.

b) Jetfuel movement by pipeline

At storage locations where jetfuel is received from refineries through product pipelines, the transport cost considered for pricing purpose is by rail from the nearest refinery in most cases.

For instance, jetfuel is also received at Delhi (Bijwasan TOP) by pipeline from Mathura refinery but the transport cost included in the ex Bijwasan storage price is rail freight from Mathura to Bijwasan. Since the pipeline movement cost is lower than rail freight, the over-recovery through the selling price is surrendered by the marketing companies to the FSP pool account.

A statement showing the unit rate of transportation of products through some of the old product pipelines is given in Annexure 6.2. These rates are substantially lower than the corresponding current rail freights. However, the unit cost of transportation through the new pipelines commissioned recently is not much different than the corresponding rail freights.

c) Jetfuel movement by road TTs from refineries and other storage locations direct to distant AFSs

For delivery of jetfuel to local AFSs from refineries or other storage locations, no separate transport charge is recovered in the selling price.

However, there are a number of distant AFSs where jetfuel supplies are delivered by road TTs over longer distances from the refineries or other storage locations. In such cases, the principle followed for jetfuel pricing is to recover notional rail freight from the nearest refinery upto the AFS. The difference between this notional rail freight and actual road transport cost incurred by the marketing companies is claimed from or surrendered to FSP pool account.

d) Coastal movement of jetfuel to port terminals

In the few cases where such movements are taking place, the port terminals are treated as secondary pricing points and separate jetfuel price is fixed by OCC under the APM for supply ex each secondary pricing point. Such a price would obviously take into account the cost of coastal movement but no split is shown.

Recovery of transport costs in jetfuel prices for despatches from the secondary pricing locations generally follows the same principle as from primary pricing points.

6.6 Jetfuel selling price build-up at AFSs for domestic airlines on the basis of basic ex storage point price given in section 6.4.

Taking computation of jetfuel selling price for domestic airlines at Palam airport, Delhi as an example, the elements to be taken into account beyond the basic ex-storage point price are summarised below:

(Rs. per kl)

Basic ex-storage point price applicable to International Airfields	Rs.10783.76
#State Surcharge	As applicable (available figure Rs.25.00)
Rail freight (Mathura-Shakurbasti)	As authorised by OCC for price build-up
Rail shunting charge at refinery and siding charge at Shakurbasti	At actuals
Assessable value for excise duty payment	Sub-total of above
Excise duty	Currently @ 16% of Assessable value
Octroi or any other local levy	Not presently applicable to jetfuel at Delhi
Posted price at Palam Airport i.e. Delhi AFS for domestic airlines	Sub-total of above
*State sales Tax on Posted price	Currently @ 11%
Final selling price, including State Sales Tax	Total of above

State surcharge imposed by OCC is to cover some irrecoverable State Government levies on inter-company transactions of product.

The current rates of sales tax in various states in the country are provided in Annexure 6.3.

Recent newspaper reports have conveyed that the Union Cabinet has decided to provide jetfuel at international prices for turbo prop aircraft flying on unviable routes such as the north-east. This implies that prices would be almost half for these routes.

6.7 Jetfuel selling price for international airlines

Since the jetfuel selling prices for domestic airlines were maintained through price control at a high level to subsidise kerosene (sold through public distribution system) and LPG (for domestic sales), the international airlines showed strong reluctance to draw jetfuel supplies at Indian international airports. Operations of Air India – the country's own international airline –

would also be severely affected if they were to pay the higher jetfuel rates applicable for domestic air traffic.

The government therefore instituted a separate basis for determining jetfuel prices for international airlines operating through India, including supply of jetfuel to the national airlines for international traffic. An empowered Standing Committee was constituted to fix jetfuel prices for international airlines, with representatives of the Ministry of Petroleum and Natural Gas, OCC and the three marketing companies IOC, BPCL and HPCL as its members. The committee closely monitors international prices of jetfuel with special attention to price levels in neighbouring countries like in Persian Gulf, Nepal, Sri Lanka, Bangladesh, Pakistan etc. It decides on the changes to be effected in jetfuel prices and IOC act as coordinators to circulate the ruling prices from time to time to all concerned. At times, the price changes can be frequent i.e. 4-5 times per month. The committee announces the final composite price to be recovered from international airlines, excluding state sales tax which is to be charged, as applicable. The declared price is indicated in cents per American gallon and in US $ per kl. It takes effect from midnight of the date of its application and any fluctuations in foreign exchange rates are adjusted by the marketing companies through jetfuel Exchange Variation Pool Account until the next change in price is introduced. The following Table 6.3 shows the recent price changes introduced by the committee:

Table 6.3 Revision in jetfuel prices applicable to international airlines at Indian airports

Effective date	Ruling pnce	
	US Cents per US gallon	US $ per kl
01-12-1999	85.49	225.84
22-12-1999	88.81	234.61
04-01-2000	89.70	236.96

International airlines have refused to pay the levy of state sales tax citing inter-governmental bilateral agreements with the US, UK and other European countries. The Indian marketing companies IOC, BPCL and HPCL have consequently been left with no other alternative but to pay the sales tax themselves and have requested the Ministry of Petroleum & Natural Gas to raise the issue with other concerned ministries of the government to get it resolved. On sales to international airlines marketing companies are entitled to retain the TAIPP of jetfuel ruling on the date of sale, their marketing margin and AFS charge at the rate due to each company. They also lodge their claims on pool accounts to recover the extra costs incurred by them on transportation of jetfuel from storage locations to the international airports.

6.8 Jetfuel price build up after dismantling of APM

The pricing method presently used by OCC for fixing prices of jetfuel is likely to be given up by public sector companies on deregulation which could be earlier than the scheduled year 2002. Prices would be based on (but not necessarily equal to) landed import prices both for domestic and international airlines. This would require that subsidies on LPG & kerosene be funded through the general budget and not by the current impost of surcharges on jetfuel (and Motor Spirit). Oil companies will need to adjust their domestic prices to recover such costs which they currently debit to the pool accounts while maintaining flexibility on international prices where a more competitive situation prevails.

Annexure 6.1

Retention price of jetfuel per tonne for Refinery-X as on 1st April, 1993

Standard Thruput	6.75 MMTPA
Retention price per tonne of crude	Rs./MT
a) Delivered cost of crude	2285.25
b) Processing cost	134.52
c) Return on employed capital	118.88
	2538.65

Refinery entitlement:-		Rs./million	
6.75 * 2538.65	=	17135.888	(A)

Part II: Product pattern, index and kerosene equivalent

Product	Quantity in '000 MT	Index	Kerosene equivalent	
LPG	222	1.15	255.30	
Motor Spirit	670	0.95	636.50	
Special boiling pt. spirits	60	1.25	75.00	
Naphtha	796	0.90	716.40	
Jetfuel	220	1.10	242.00	
Kerosene	712	1.00	712.00	
Mineral Turpentine	55	1.10	60.50	
High Speed Diesel Oil	2197	0.95	2,087.15	
Low Sulphur High Flash diesel oil	200	1.15	230.00	
Light Diesel Oil	120	0.85	102.00	
Fuel Oil	381	0.60	228.60	
Low Sulphur Heavy Stock	579	0.55	318.45	
Bitumen	280	0.70	196.00	
Vacuum Tower Bottoms	(50)	0.70	(35.00)	
Total	6442			
Fuel & Loss	308			
Total	6750		5824.90	(B)

Determination of retention prices for kerosene & jetfuel

	Rs./MT	
$\frac{A}{B} = \frac{17135.888 \text{ million}}{5824.90}$	2,941.83	(C)
Index for Kerosene	1.00	
Retention price of Kerosene: C x 1.00	= 2,941.83	
Index for jetfuel	1.10	
Retention price for jetfuel: C x 1.10	= 3,236.01	
	Or 2512.43 (per kl)	

Annexure 6.2

Statement showing unit rate of transporation of product pipelines w.e.f 1/4/1990 to 31/3/1993

Product pipelines	Standard throughput MMTPA	Rate (Rs./MT)
Indian Oil Corporation		
Gujarat – Ahmedabad	1.100	28.15
Guwahati – Siliguri	.818	57.94
Barauni – Patna – Mugalsarai – Allahabad - Kanpur	1.800	51.35
Haldia – Maurigram – Rajbandh – Barauni	2.650	45.46
Mathura – Delhi	3.700	15.91
Delhi – Ambala	2.200	16.12
Ambala – Jalandhar	1.350	24.10
Hindustan Petroleum Corporation Ltd.		
Mumbai – Pune	2.000	83.41

Annexure 6.3

Current rates of sales tax on jetfuel

State/UT	Entry tax (%)	Sales tax (%)	Surcharge (%)
Andaman & Nicobar Is.		NIL	
Andhra Pradesh		30.55	
Arunachal Pradesh		NIL	
Assam		25	10
Bihar		25	
Chandigarh		Rs.0.15 per litre	
Delhi		11	
Goa		20	
Gujarat		23	20
Haryana		10	
Himachal Pradesh		10	
Jammu & Kashmir		8	5
Karnataka		22	5
Kerala		20	
Madhya Pradesh		20	15
Maharashtra		25	
Manipur		10	
Nagaland		15	
Orissa		20	
Punjab		8	10
Rajasthan		20	12
Tamil Nadu		24	
Tripura		25	
Uttar Pradesh		20	
West Bengal		25	15

7

Observations and conclusions

.1 Policy issues

Despite the announcement by Government in 1997 of a civil aviation policy for the country not much progress has been made. The induction of domestic private airlines took place well before 1997. The disinvestment/privatisation of Air India and Indian Airlines still seems a long way off. Apart from the new international airport at Cochin, which is privately owned, no other private airport has been established though Government have very recently announced that 5 major airports will be given out on long lease. The issue of foreign airlines owning equity in private airlines in India was ruled out earlier but could still see a comeback. A new civil aviation policy is now expected in the year 2000.

.2 Jetfuel demand

There has been a steady growth over the past few years and this is expected to continue in the future. Jetfuel sales doubled in the 18 years from 1981 to 1999 and is expected to double again in the next 10 years in the alternate scenario. Driving forces will be the growth in industrial GDP for domestic sales and the number of passengers carried in the case of international sales.

.3 Jetfuel supply-demand balances

After many years India has reached self-sufficiency in refining capacity though increasingly dependent on imported crude. The capacity to manufacture jetfuel is still in excess of demand and this is likely to continue through till 2010-11. Therefore there will be no need to import jetfuel, though in a deregulated scenario imports of all products including jetfuel should be permissible. Whether product imports will be an economic proposition will depend, inter-alia, on the extent to which Government provides duty protection to the Indian refining industry. At present an inverted duty structure prevails where crude oil has a considerably higher customs duty rate compared to products. But this is expected to be reversed by the time full deregulation is achieved. In the case of jetfuel imports there will be a custom duty refund for international sales and therefore the level of duty protection on products may not be relevant.

7.4 Jetfuel supply logistics

Though two of the international airports (Delhi and Mumbai) are supplied directly by pipeline from a refinery, supply to most of the other airfields is usually a 2 or 3 stage process with the final delivery being made by tanktrucks. This is not expected to change until the network of pipeline being planned in various parts of the country are commissioned and used not just for white oils (motor spirit, naphtha, high speed diesel oil and kerosene) but also for jetfuel. If the quantity of jetfuel to be moved is small, quality and interface requirements may discourage transportation by pipeline. The ability to service an airport from more than one supply point often militates against pipeline supply.

If an importer wishes to bring jetfuel into the country (subject to what has been said earlier) it is unlikely that the existing oil companies will provide ullage/facilities to assist a competitor. However, there are few private parties that have put up product storage terminals at Mumbai, Vishakh and Kandla and they may be interested in switching their kerosene tanks/facilities to jetfuel subject to QC upgradation where required.

7.5 Jetfuel infrastructure at airports

The three public sector oil companies have a monopoly at present, with IOC by far the biggest operator. Apart from hydrant fuelling system at Delhi, Mumbai and now at Cochin at all other airports fuelling is by refuellers, though Calcutta will have a hydrant system shortly. As these aircraft fuel stations are frequently inspected by QC teams of the oil companies themselves and by those of the contracted airlines, standards are at international levels and facilities are well maintained. Competition to secure additional business (new airlines or new routes) has been stiff for quite some years now and is expected to intensify in the future.

7.6 Jetfuel pricing

The move towards import parity pricing has already taken place and should be completed along with deregulation of the oil industry and removal of administered prices. This is scheduled for the year 2002 but could be earlier. The sales tax issues meanwhile continues unresolved.

7.7 Opportunities for KPIAC to market jetfuel

With manufacturing capacity in the country continuing to be in excess of demand, the opportunities to import jetfuel at one location and swap for jetfuel deliveries at another location seems remote through they may be niche opportunities. However, KPIAC's share of production from the proposed Paradip refinery does give opportunities to swap unlike products for jetfuel.

A major issue, however, for a new entrant is creating the necessary infrastructure at the airports. BPC and HPC have been in the aviation business for many years but have found it difficult to expand their network and their combined market share is only 30%. The erstwhile Burmah Shell (now BPC) had the largest network 35 years back, but sold most of its stations to IOC as part of its disinvestment programme. It is not been able to establish itself again at more than a handful of stations in the 24 years that it has been in the public sector. This is partly because at many airports more than one jetfuel supplier is not required and partly because land for a second supplier to put up storage tanks and parking facilities for refuellers is just not available. The concept of shared storage facilities or a single operator for the oil industry (other than where there is a hydrant system) has not materialised and with IOC wanting to protect its turf is unlikely to take place unless airport authorities insist. Privatisation of airports may make this happen.

One disadvantage that Indian oil companies face is that they are not represented abroad. If KPIAC is able to put up or share in AFS facilities it should be in a position to persuade some airlines, which it is servicing abroad, to switch to KPIAC in India.